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ABSTRACT

A three-year research effort was conducted to design a crime laboratory proficiency testing program encompassing the United States. The objectives were to: (1) determine the feasibility of preparation and distribution of different classes of physical evidence; (2) assess the accuracy of criminalistics laboratories in the processing of selected samples of physical evidence; (3) conduct statistical studies of the tests administered; and (4) establish the basis for the design of education and self-improvement programs which will assist the criminalistics profession to higher levels of proficiency. The following types of samples were manufactured, packaged and distributed: controlled substances, blood, paint, glass, hair, fibers, firearms, physiological fluids (semen, saliva), questioned documents, wood, arson accelerants, soils, and metals. The data were analyzed by giving full, partial or no credit, depending upon how thoroughly the work was performed. It was concluded that voluntary, anonymous proficiency testing is both feasible and necessary, and that there is a need for ongoing proficiency testing. A wide range of proficiency levels was found among the nation's laboratories, with several evidence types posing serious difficulties for the laboratories. The majority of laboratories lacked the financial resources to participate in a proficiency testing program on a fee basis. Several recommendations were made. (Author/GDC)

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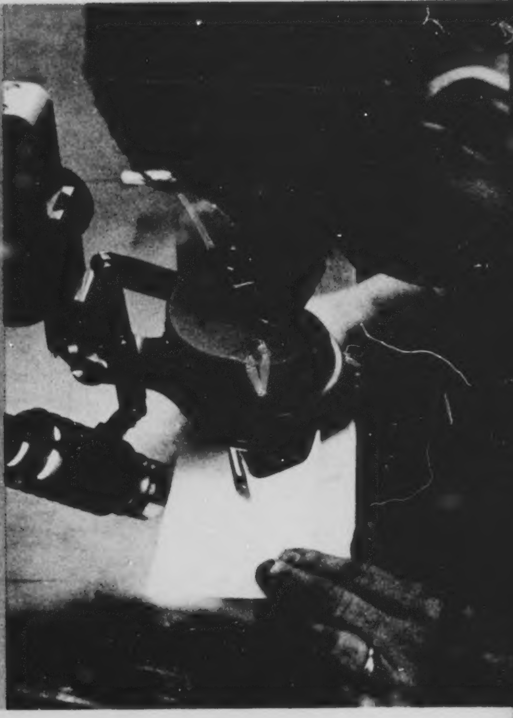

National Institute of Law Enforcement and Criminal Justice
Law Enforcement Assistance Administration
United States Department of Justice

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Crime Laboratory Proficiency Testing Research Program

by

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FOREWORD

Periodically, it is necessary to place proficiency testing programs in the proper perspective with all other laboratory activities that attempt to maintain or enhance the quality of services provided. Proficiency testing is not a panacea for all possible laboratory problems; it cannot solve problems directly traceable to inadequate facilities, nor to those associated with budgetary shortcomings. In fact, proficiency testing is not the only so called, quality assurance program available. Any special effort to develop or maintain quality in laboratory performance is properly called a quality assurance program. Education and in-service training programs fit the description, as do a myriad of quality control measures such as periodic calibrations of instruments and programed checks made on reagents. No individual quality assurance program can be said to be more important than another. All are needed and serve a special purpose.

Thus, proficiency testing fulfills a particular need, that of providing an external (independent) evaluation of laboratory performance. Most internal quality control programs use a structured set of reference materials of publicly known specifications to openly check particular types of examination in a laboratory. Proficiency testing, on the other hand, uses a battery of varied test samples of known but unpublicized specifications to test laboratories as entities, specific teams within the laboratories, or individuals within the laboratories.

This proficiency testing program was not conceived primarily as a means to assess the state-of-the-art, nor was it necessarily viewed as an ongoing program. Rather, the principal purpose of this endeavor was to determine the feasibility of proficiency testing as a tool to uncover potential problem areas in laboratory performance. It was a research project concerned with how to design a testing program that could be implemented by the profession as a continuing, self-sustaining program. However, as a result of the research performed, it was anticipated that knowledge could be gained relative to the general strengths and weaknesses of the laboratories with a view toward supporting longer range efforts of research and action programs.

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EXECUTIVE SUMMARY

This final report is the culmination of a three-year research effort to design a crime laboratory proficiency testing program encompassing the entire United States. Because the profession acknowledged the existence of wide variations in criminalistics laboratory performance throughout the nation, and because no national program to test the analytical accuracies and proficiencies of crime laboratories existed prior to 1974, the primary objectives of this research project centered on determining how to prepare and distribute specific samples, how to analyze laboratory results and how to report those results in a meaningful manner. The purpose of the project was to see if such a proficiency testing system was even feasible, to try to achieve maximum participation of all crime laboratories in the country and to gradually undertake a nationwide state-of-the-art assessment of crime laboratories. The stated objectives of the research addressed the following topics:

- Determine the feasibility of preparation and distribution of different classes of physical evidence for nationwide distribution;
- Assess the accuracy of criminalistics laboratories in the processing of selected samples of physical evidence;
- Conduct statistical studies of the tests administered;
- Establish the basis for the design of education and self-improvement programs which will assist the criminalistics profession in the attainment of higher levels of proficiency.

Because this constituted a pilot study utilizing untried manufacturing and sample distribution techniques, untested questionnaires and completely new methods for analyzing responses from the crime laboratories, the Law Enforcement Assistance Administration and the Forensic Sciences Foundation assured all participating laboratories that they would remain anonymous and that all research and statistical data would be considered confidential. Most crime laboratories in the country elected to participate in the program since the primary thrust of the project was to benefit the laboratories by giving them insight into their own proficiencies and shortcomings, allowing them to compare and contrast their procedures and capabilities with other laboratories around the country. Indeed, the program was launched with an unprecedented participation rate. Participation for the initial three test samples, for example, was 90%, 78% and 81% respectively.

Unlike other clinical and commercial testing laboratories, crime laboratories are frequently required to examine micro-quantities of physical materials which are contaminated. These materials, which are gathered from the victims and scenes of crimes, constitute serious problems for such a proficiency testing program, since virtually identical samples had to be manufactured and mailed to more than 200 laboratories around the country. With guidance from a Project Advisory Committee composed of eight nationally recognized crime laboratory directors and academicians, the following types of samples were manufactured, packaged and distributed: controlled substances, blood, paint, glass, hair, fibers, firearms, physiological fluids (semen, saliva), questioned documents, wood, arson accelerants, soils and metals. Each physical evidence category presented a new set of problems to the staff and advisory committee, for never before had efforts been made to construct so many homogeneous samples.

Although numerous problems were encountered in the course of the project, valuable lessons were learned and documented in the areas of sample selection, packaging and mailing. Various data gathering instruments were tested and evaluated for the purpose of receiving and analyzing the responses of the laboratories. Also, the individual sample types posed unique problems, necessitating constant monitoring and revision of data collection instruments. One of the primary adjustments made to suit the characteristics of each physical evidence type was the use of open-ended questions on the data sheets. As a result, the approach used in the analysis of the data was more akin to the grading of an essay where the grader can assign full, partial or no credit to the essay depending upon how thoroughly the writer treated his subject. As a result, the data could not be subjected to classical forms of statistical analysis.

Many of the tests also called for laboratories to attempt to "individualize" the physical materials, that is, to conclude if two or more items (glass fragments, for example) shared a common origin or source. The criteria by which an examiner may offer an opinion of common origin or individuality is a continually evolving concept which takes on different meanings to different laboratories across the country, depending upon their level of expertise and availability of sophisticated instrumentation.

The findings of this study range from the specific (e.g., paint testing) to the general, where the same type of error surfaced in more than one evidence category. In addition to classifying the responses for each test sample on a correct/incorrect basis as the project proceeded, an effort was made to develop criteria which could be applied to all categories at the close of the project. The "unacceptable proficiencies" and criteria utilized to place responses in such a category are summarized in Chapter IV, Findings. The reader is cautioned to view such data with care, for the research design of the project did not concentrate on assuring precision or accuracy of the data collection. The most obvious clue to this is that some of the evidence types were only submitted to the laboratories for one evaluation, and no type was submitted for more than three. The determination of precision and accuracy, by their very definitions in a scientific sense, requires multiple testings--reproducibility and the ability to derive an average are requisite, and none of the sample tests was similar enough that such criteria could be judged.

A number of general findings were formed at the conclusion of the project, among them:

- Voluntary, anonymous proficiency testing is both feasible and necessary as indicated by the consistently high participation rates throughout the course of the project and the ability of such testing to identify areas in need of improvement.

- There is a need for continuous, ongoing proficiency testing to provide a means to monitor efforts to upgrade and maintain high quality criminalistics services;
- A wide range of proficiency levels among the nation's laboratories exists, with several evidence types posing serious difficulties for the laboratories;
- The majority of laboratories queried lack the financial resources to participate in the proficiency testing program on a subscription (fee) basis.

In response to these findings, the Forensic Sciences Foundation and the Project Advisory Committee have formulated several recommendations, including:

- A nationwide program of continuous proficiency testing of crime laboratories should be established and administered by a peer group;
- Future proficiency testing programs should contain provisions to render technical assistance to the laboratories which desire and request such help;
- A series of regional workshops to address education and training needs corresponding to deficient areas as identified in this project should be developed immediately;
- Law enforcement agencies at all levels of government must recognize that the problems identified in the research findings are symptomatic of inadequate budgets, and both physical and human resources and should allocate the necessary funds to correct such deficiencies.

Although more intangible than the previously stated findings, this proficiency testing project has been an "eye opener" to many laboratories, causing some directors to re-examine their tests and procedures in selected physical evidence examination areas. Many laboratory directors have stated flatly that proficiency testing has been the most successful program ever funded on a national basis for it allowed them to compare themselves with other crime laboratories and was the stimulus to initiate programs for improvement which now are yielding very tangible benefits to the justice system.

Many of the findings of this report are neither new nor unexpected to anyone who has kept abreast of the literature emanating from the evaluations and task force reports addressing crime laboratories. Some of the difficulties experienced by the laboratories could only be expected as all of the previous reports which have addressed this issue have inferred the likelihood of such findings. Many laboratories are not demonstrating optimal proficiencies because it is circumstantially impossible for them to do so. The causal relationships between budgetary and operational problems and the degree of laboratory proficiency are complex, yet limited budgets, poor or nonexistent education and training programs, high backlog of cases, insufficient numbers of scientific personnel and overcrowded facilities with outdated equipment may adversely affect the proficiency of a laboratory. This report documents that crime laboratories have been and are still in need of help.

The proficiency testing program has been controversial in that many laboratory directors wondered whether the research findings would constructively or destructively affect the laboratories. To deliberately document the shortcomings of the crime laboratory operations and then walk away from them would be completely destructive and senseless. However, based on previous experiences where needed aid has been refused, many of the directors feared this. In the best interest of both the crime laboratory as well as equitable criminal justice, the proficiency testing program was ultimately supported by the laboratory directors with the optimistic hope that the results would compel a change for the better. Indeed, the findings of the proficiency testing project should be the last straw in bringing whatever aid is necessary to the crime laboratories. The laboratories acknowledge that they are helpless without the support of the federal, state and municipal governments, and it is to them that the crime laboratories must turn for aid in taking remedial measures and securing adequate resources for improved laboratory operations.

Aside from greater resource allocations to the laboratories at the local level, the most pressing needs of the crime laboratories fall into the areas of qualifications and possible certification of personnel, accreditation of crime laboratories, accreditation of forensic science degree programs, regional workshops to upgrade the training of current laboratory personnel, research for improved techniques in the analysis of the various physical evidence types, and, of course, a means for continued proficiency testing. The criminalistics community has already addressed many of these needs and has developed several others into concept papers or grant proposals for federal support.

As a final note, the proficiency testing research project has shown that crime laboratories can be extremely proficient. Many of the laboratories around the country displayed excellence in the examination and analysis of virtually all the categories of physical evidence submitted by the project staff. This is, without a doubt, a great tribute to those laboratories, as well as to their supporting agencies and local government.

CHAPTER I

PROJECT BACKGROUND

INTRODUCTION

It can be said of the Laboratory Proficiency Testing Research Program that it is "**an idea whose time has come."[1] The history of proficiency testing in the field of criminalistics when coupled with the results of this specific program bear out the validity of that statement.

This report covers the tasks performed under two LEAA grants given to the Forensic Sciences Foundation, Inc.: "Laboratory Proficiency Testing", Nr. 74-NI-99-0048 (covering the period July 1974 to April 1976) and the continuation grant, "Laboratory Proficiency Testing Research Project", Nr. 76-NI-99-0091 (for the period April 1976 to May 1977).

OTHER PROFICIENCY TESTING PROGRAMS

Prior to the initiation ofthis program no broad spectrum, nationwide proficiency testing program for criminalistics laboratories had been attempted. In the late 1950's and continuing through the late 1960's the Criminalistics Section of the American Academy of Forensic Sciences conducted a proficiency test that was national in coverage but sporadic and limited in scope. They could best be described as exploratory or feasibility studies of the need for such a program. The conclusion reached was that there was an urgent need for developing a program such as the one implemented in this LEAA project.

In the past, and in many cases today, a number of individual laboratories have been and are conducting self-testing systems. In addition, some states have established limited monitoring activities in this field. Some regional efforts have been made, and some specific testing has been or is being conducted by various government and private agencies. Examples of the latter include: U.S. Department of Transportation - Blood/Alcohol Testing; Drug Enforcement Administration - Internal Proficiency Testing; National Bureau of Standards; Clinical Laboratory Proficiency Testing for the Center for Disease Control in selected areas of Clinical Chemistry, Hematology and Microbiology;

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[1] "Greater than the tread of mighty armies is an idea whose time has come." Victor Hugo, Historie d'un Crime, 1852.

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College of American Pathology in Hospitals and Clinical Pathology Laboratories.

All of these efforts have made significant contributions to the study of laboratory problems and their solution. However, none of these programs has provided a mechanism by which comparisons in the variations of laboratory performances can be made...to the end that all laboratories can be assisted in the upgrading of their service.

CATALYST FOR THIS PROJECT

In 1974 the proper catalyst for a national, continuing proficiency testing program was found. In early 1974, LEAA indicated an interest in funding a meaningful research program in the field of criminalistics and, almost concurrently, at the 1974 Annual Meeting of the American Academy of Forensic Sciences, the Criminalistics Section held discussions to find a means for assessing the performance and quality of services of the crime laboratories throughout the United States.

At that meeting it was acknowledged that, because the nation's laboratories had developed independently, a wide variety of techniques and instrumentation had also been developed...resulting in a wide variation in the quantity and quality of services provided. What was not known was: specifically, how well the nation's laboratories were performing in particular types of examinations, what their true capabilities were, which methods were being employed for the examination of physical evidence, and a multitude of other related matters. In short, the profession acknowledged that the state-of-the-art of criminalistics laboratories was unknown. That common concern was shared by LEAA's National Institute of Law Enforcement and Criminal Justice, thus giving rise to the research which is the subject of this report.

PROFESSION MISGIVINGS

It would be less than candid to imply that all laboratories or criminalists in the field endorsed the concept of a nationwide proficiency testing program. Skepticism centered on four points.

The first was the traditional concern that independence of operation (a characteristic of autonomy) would be seriously eroded by allowing outside access to individual laboratory operations. This question was resolved by showing the laboratories that the testing mechanics precluded any direct involvement in the operations of any specific laboratory. Rather, because the project was a research effort in "how to run proficiency testing", its impact would be on the profession as a whole...a generic approach to the problems of the profession.

The second area was the issue of standardization. Some individuals felt that proficiency testing could lead to requirements that certain instruments and methods be used to analyze the materials submitted to the crime laboratory.

The third area of concern related to the profession's direct involvement in the design and administration of the tests. It was agreed by the leaders in the field that few, if any, laboratories would participate in even a pilot proficiency program unless convinced that the profession itself would have a strong hand in designing and guiding the project. The creation of a Project Advisory Committee (comprised of eight prominent criminalists in the field) and their assignment to specific project planning, design and operational responsibilities proved to be a satisfactory solution to this problem.

The last major area of concern...confidentiality of data and total anonymity of laboratories...proved to be the most difficult to resolve. The equation in need of solution was:

Guaranteed Confidentiality of Data
Voluntary participation = Plus
Anonymity of Laboratories

The official documents and files on this project attest to the continued, intense concern over this matter, to include: the Initial Concept Paper; the Grant Proposal; the Official Grant Award; Correspondence with individual laboratories; Speeches; Project Reports; and Project Advisory Committee Meeting Minutes.

Two safeguards were utilized to guarantee confidentiality and anonymity. The Foundation established temporary, internal administrative procedures to severely limit access to selected files. In effect, only one individual had the means to link a laboratory name with a test result...and that linkage was only established to ensure that the specific reports were credited to the right laboratories. The second safeguard was generated by LEAA. The Grant Award contained the following statements:

"SPECIAL CONDITIONS"[2]

- "The Forensic Sciences Foundation shall advise respondents that information is being collected for research and statistical purposes only. Such information will not be revealed or used for any other purpose. Information furnished by any person or agency and identifiable to any specific person or laboratory will not be revealed or used for any purpose other than the research and statistical purposes for which it was obtained.

- Any questionnaires prepared for completion by study subjects shall include the following notation:

> 'Information on this questionnaire is being collected by the Forensic Sciences Foundation in connection with a grant from LEAA. The information has not been requested by and is not intended for the use of LEAA.'"

The first grant was approved by LEAA in July 1974 under the title, "Laboratory Proficiency Testing", #74-NI-99-0048. It was renewed for one year in April 1976 as the "Laboratory Proficiency Testing Research Project", #76-NI-99-0091.

SPECIFIC OBJECTIVES - INITIAL GRANT

Three factors exercised considerable influence on the decision as to what would be the objectives for the initial grant:

- the wide variety of samples that would be required

- the voluntary nature of the participation

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[2] Paragraphs 8 & 10, "Statement of Special Conditions", 74NI-99-0048 4/15/74 and Paragraphs 1 & 2, "Statement of Special Conditions", 76NI-99-0091, 3/30/76.

- the absence of any specific base of knowledge for a project of this magnitude.

Experts in the field of clinical laboratory proficiency testing cautioned that the samples should be limited to a very narrow subclass of one generic type of evidence...such as blood. They reasoned that it had taken them a number of years to develop their manufacturing and testing techniques. We could expect no less a problem.

These same experts also felt that the unqualified voluntary nature of the program would create many problems. It was felt that large numbers of laboratories might not participate if it were not required that they do so.

Finally, it was acknowledged that progress would be slow and sometimes painful because the concept was new and without any true base of past experience or data.

Accordingly, the following specific objectives were established for the initial grant.

OBJECTIVES--FIRST GRANT

- Through the use of voluntary, anonymous proficiency testing, assess the analytical accuracy of criminalistic laboratories in the processing of selected physical evidence.
- Make statistical studies of laboratory proficiency in the processing of open proficiency test samples and of the accuracy and precision of the various analytical methods used.
- Establish the basis for the design of Educational Programs, in the area of analytic methods, which will assist the criminalistics profession in the attainment of higher levels of proficiency.

SPECIFIC OBJECTIVES - SECOND GRANT (EXTENSION)

Based on the experience gained in the first two years of operation of the proficiency program, it was evident that the grant language should emphasize the research nature of the project. In a sense, the earlier warning of experts in proficiency testing were right.

It was very difficult to design samples and testing procedures for a wide variety of samples. Where those experts were wrong was in their belief that it could not be done.

Thus, the Second Grant proposal included the following language:

> "It was and will continue to be a research study of how to prepare and distribute specific samples; how to analyze laboratory results; and how to report those results in a meaningful manner."[3]

The objectives for the second grant were modified to reflect this more pragmatic view of the research being accomplished.

OBJECTIVES--SECOND GRANT

- Determine the feasibility of preparation and distribution of different classes of physical evidence for nationwide testing.
- Assess the accuracy of criminalistic laboratories in the processing of selected samples of physical evidence.
- Conduct statistical studies of the tests administered.
- Establish the basis for the design of educational and self-improvement programs which will assist the criminalistics profession in the attainment of higher levels of proficiency.

ULTIMATE PROJECT GOAL

Beginning with the earliest discussions, it was accepted that the long range goal of the LEAA Grant was to design a voluntary proficiency testing program that would eventually be a continuing program through paid laboratory subscriptions. LEAA would support the "how to" research necessary to develop such a program. A key to the attainment of this goal was the requirement to introduce as many different types of samples into the system as possible, yet still allow some repetition of tests so as to provide data on short term improvements in performance.

In all, 21 samples were tested, leaving many types of physical evidence still to be researched but still providing a base of knowledge for the initiation of a self-supporting program.

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[3] First Paragraph, Part IV, Program Narrative, "Project Plan Summary, Application for Federal Assistance, January 27, 1976

PARTICIPATING LABORATORIES

As noted earlier in this section, concern was exhibited by many experts that very few laboratories would voluntarily participate in the program. Estimates of the expected participation rate varied from a pessimistic low of 25 laboratories to a high of 50 to 60 laboratories. Assuming that a program of quality would be developed, professionals in the field agreed that sustained participation could be expected from approximately 30-40 agencies with sporadic participation from a few limited service laboratories.

The actual participation rate and results will be discussed in subsequent sections of this report but for purposes of this portion of the report suffice it to say that participation exceeded all expectations. Approximately 240 laboratories were carried on the project rolls during the period 1974-1977. The highest participation was 205 (drugs) and the lowest 65 (wood examination). Fourteen of the 21 tests drew data responses from more than 100 laboratories; the participation average was approximately 118 laboratories per test. A roster of laboratories that participated in any or all tests is included in Appendix A of this report.

In terms of jurisdiction, 2% of the participants were Federal laboratories, 57% were State or Regional Laboratories, 40% were local and the remaining 1% were private or Canadian government laboratories.

By far, the largest number of laboratories (66%) employed from 1 to 9 criminalists, 23% employed from 10 to 19 criminalists and the remaining 11% of the 240 laboratories each had staffs of more than 20 criminalists.

CHAPTER II

METHODS

INTRODUCTION

The success of a research project is dependent upon the mechanism used to accomplish the stated goals or objectives of that project. These mechanisms are generally referred to as methods and this chapter explains how the various operations within this project were designed, implemented and evaluated. It is essential to have an understanding of the specific methods used in the course of this project because the results must be judged in the context of the nature of the testing.

This chapter illustrates the complex relationship between a given question and the steps to be taken to gather the information which constitutes an answer to that question.

The material presented in this chapter is in the following format:

- ORGANIZATION
- TEST DESIGN
- TEST EXECUTION
- TEST STATISTICS
- TEST EVALUATION
- PROJECT EVALUATION

In as much as this research was conducted over a three year period under two grants from NILECJ (#74NI-99-0048 and #76-NI-99-0091) the methods described herein will be those employed in the latter grant (#76-NI-99-0091). In instances where there are substantial differences in the operations of the two grants, those variations will be noted. Overall the two projects were conducted in the same general manner. Several of the differences are apparent in the latter project as a result of information learned by experience, i.e., a particular mode of operation proved to be unsuccessful or cumbersome in accomplishing its stated task, therefore it was modified to better carry out its purpose. The overall result of these changes was a more "streamlined" efficient operation. Those procedures which did not work at all or did not work well were replaced with procedures which did in fact, work.

The flow charts which follow in Figures 1, 2 and 3 are those which represent the operational steps in Project #76-NI-99-0091.

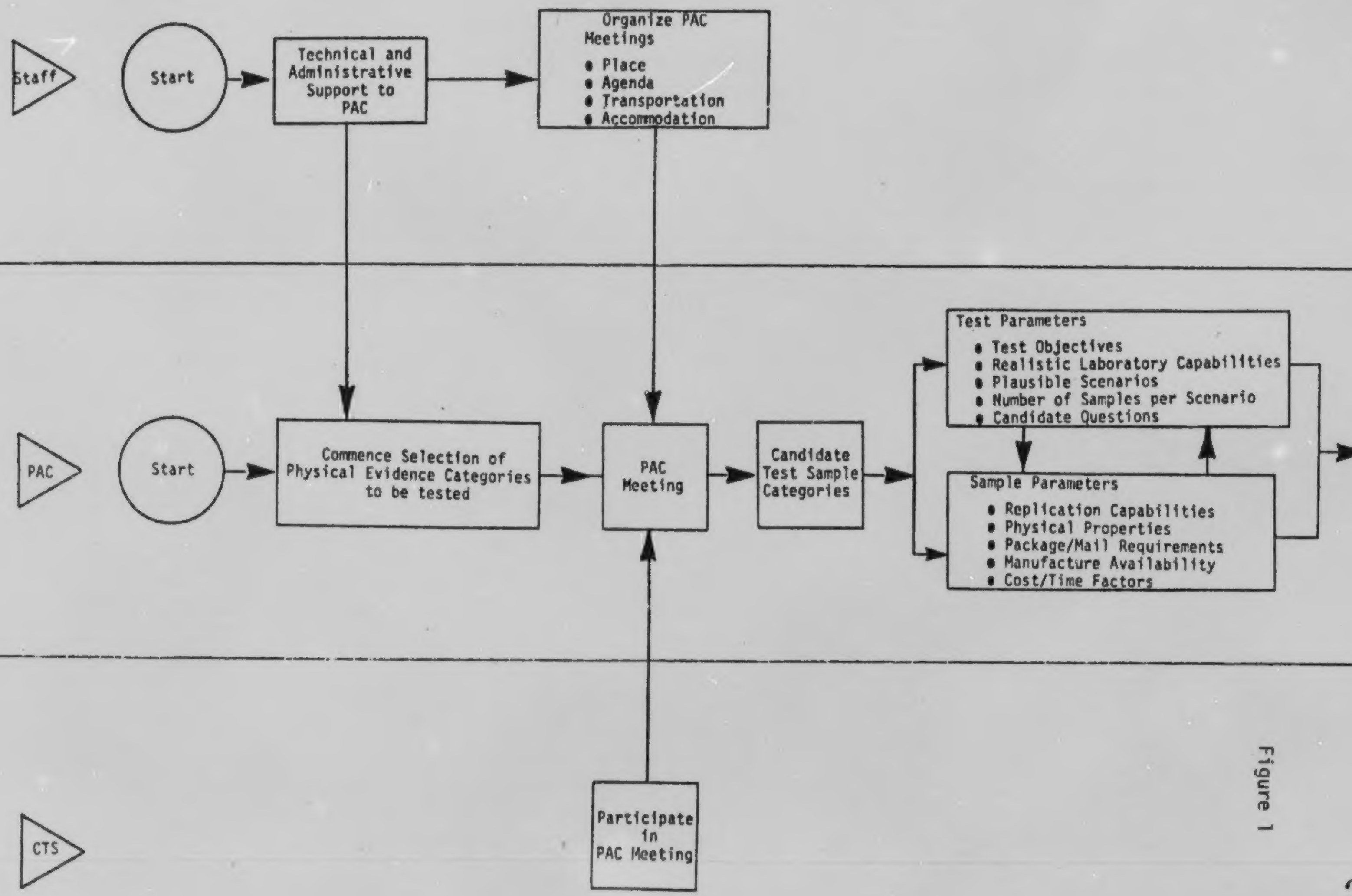
Staff
Start
Technical and Administrative Support to PAC
Organize PAC Meetings
• Place
• Agenda
• Transportation
• Accommodation
PAC
Start
Commence Selection of Physical Evidence Categories to be tested
PAC Meeting
Candidate Test Sample Categories
Test Parameters
• Test Objectives
• Realistic Laboratory Capabilities
• Plausible Scenarios
• Number of Samples per Scenario
• Candidate Questions
Sample Parameters
• Replication Capabilities
• Physical Properties
• Package/Mail Requirements
• Manufacture Availability
• Cost/Time Factors
CTS
Participate in PAC Meeting

Figure 1

9/88

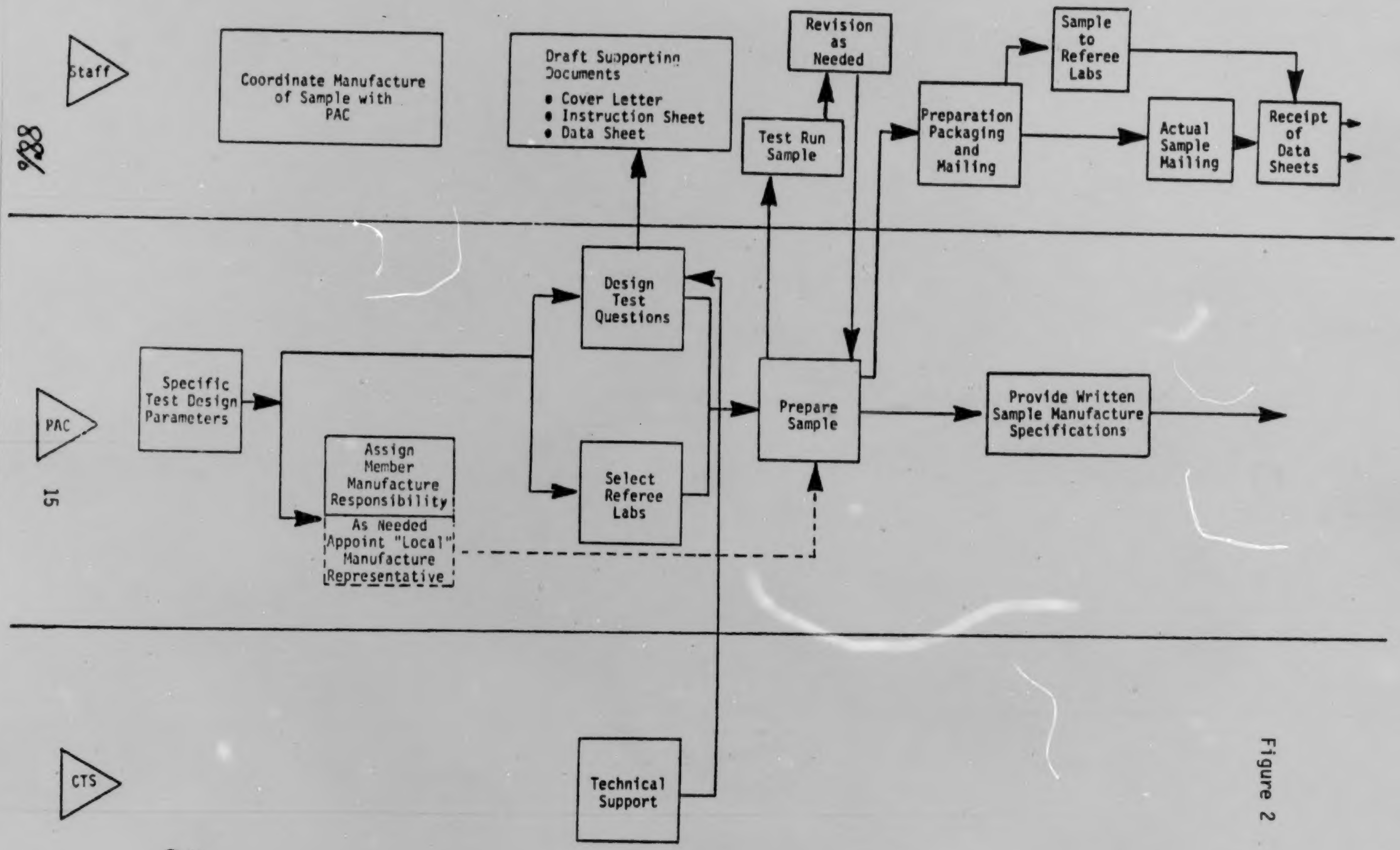
Staff
PAC
CTS
Coordinate Manufacture of Sample with PAC
Draft Supporting Documents
• Cover Letter
• Instruction Sheet
• Data Sheet
Revision as Needed
Test Run Sample
Sample to Referee Labs
Preparation Packaging and Mailing
Actual Sample Mailing
Receipt of Data Sheets
Specific Test Design Parameters
Design Test Questions
Assign Member Manufacture Responsibility
As Needed Appoint "Local" Manufacture Representative
Select Referee Labs
Prepare Sample
Provide Written Sample Manufacture Specifications
Technical Support

Figure 2

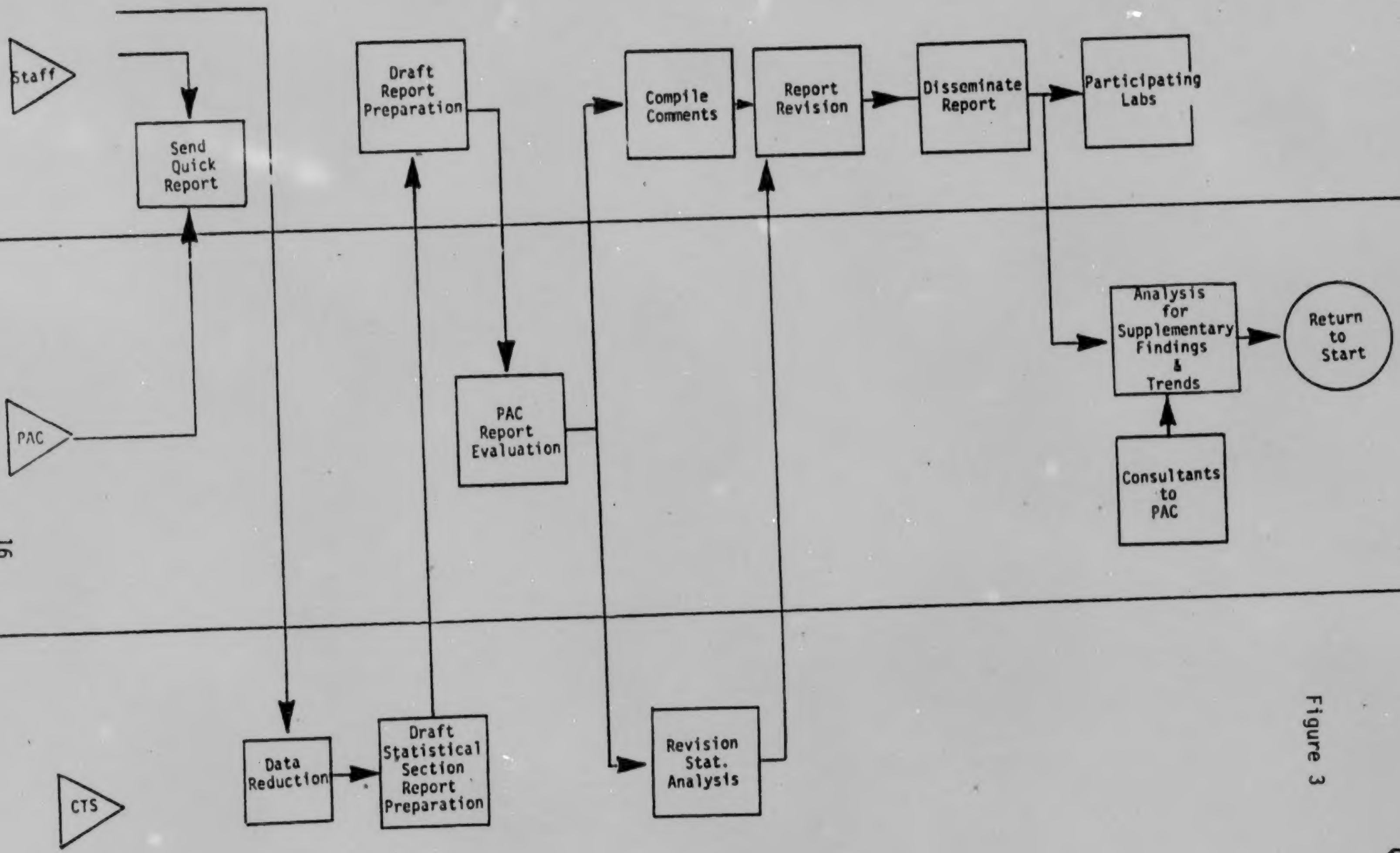
Staff
Send Quick Report
PAC
CTS
Data Reduction
Draft Statistical Section Report Preparation
Draft Report Preparation
PAC Report Evaluation
Compile Comments
Revision Stat. Analysis
Report Revision
Disseminate Report
Participating Labs
Analysis for Supplementary Findings & Trends
Consultants to PAC
Return to Start

Figure 3

ORGANIZATION

Figure 4

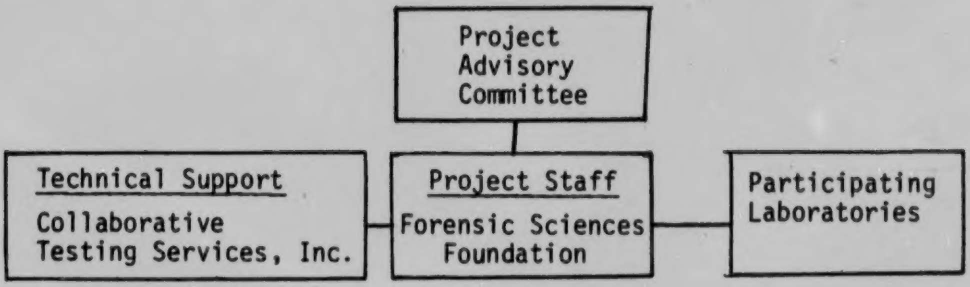
Project Advisory Committee
Technical Support
Collaborative Testing Services, Inc.
Project Staff
Forensic Sciences Foundation
Participating Laboratories

Figure 4 illustrates the basic organization of the Project.

From its inception, the concept of conducting a nationwide program in the criminalistics profession required the active participation of members of that profession. Since the areas being investigated did not lend themselves to the more traditional, clinically oriented proficiency testing, it was necessary to gain the cooperation of individuals who were thoroughly familiar with the function and operation of the crime laboratory. Based on the need for this caliber of expertise, the Project Advisory Committee was formed. The need for supporting technical services was recognized and the capabilities of the Law Enforcement Standards Laboratory of the National Bureau of Standards (NBS), U.S. Department of Commerce were tapped. During the course of the project, the technical services requirements were reassessed and, with the concurrence of NBS, the operation transferred to Collaborative Testing Services, Inc. of Vienna, Virginia.

Project Advisory Committee (PAC)

The Project Advisory Committee held the responsibility for the overall project guidance and evaluation. It was composed of eight prominent members of the criminalistics profession, each having extensive criminalistic laboratory management and academic experience.

The members of the committee were:

J. F. Anderson, BS

J. D. Chastain, BA

R. H. Fox, BS

A. Longhetti, BA

C. A. McInerney (deceased)

A. H. Principe, BS

J. I. Thornton, D. Crim.

E. Whittaker, BS

The responsibilities assigned to the PAC covered the execution of various tasks toward the completion of the project according to the stated goals. They included:

- Establishing the overall goals which a project of this nature seeks to meet

- Insuring a high percentage of participation

- Establishing which categories of physical evidence are suitable for testing

- Defining the test parameters to include:

    Test objectives
    Laboratory capabilities
    Plausible scenarios
    Number of samples per scenario
    Candidate questions

- Establishing the sample parameters to include:

    Replication capabilities
    Physical properties
    Packaging and mailing requirements
    Manufacture availability
    Cost/time factors

- Assigning of manufacture responsibility
- Design of test questions
- Referee laboratory selection
- Sample manufacture and preparation
- Written for each sample specification
- Evaluation of test sample reports
- Analysis of collected data for supplementary findings
- Provide peer group liaison with the professional community

Technical Support

Technical support to this project was provided by Collaborative Testing Services, Inc. (CTS) of Vienna, Virginia. The services provided included:

- Participation in planning meetings.
- Lending technical expertise to the PAC to assist in the design of specific test questions.
- Data reduction of returned results.
- Preparation of statistical presentation of returned results.

Additional services, such as maintenance of mailing lists and generation of computer-labels were also provided by CTS.

As briefly noted earlier, at the outset of this project in July 1974, the activities cited above were performed by the National Bureau of Standards under an agreement with LEAA. Staff support was supplied to them by personnel of the Collaborative Testing Services, Inc., (CTS) under contract to NBS.

By mutual agreement with LEAA, NBS and the Foundation, the National Bureau of Standards discontinued involvement in the program after December 31, 1975. From that time to the conclusion of the second grant, technical support was accomplished by direct subcontract of CTS to the Foundation.

Forensic Sciences Foundation, Inc.

The Forensic Sciences Foundation, Inc. acting in the capacity of Project Staff was responsible for the execution and administration of the project to include the activities of the PAC, the Participating Laboratories and the technical support provided by Collaborative Testing Services, Inc. under subcontract to the Foundation.

Participating Laboratories

In the fall of 1974, invitations were extended to all criminalistics laboratories in the U.S. to participate in this Proficiency Testing Project. The names and locations of these laboratories were compiled from existing sources and listings. Those sources included the National Institute of Law Enforcment and Criminal Justice (NILECJ), Federal Bureau of Identification (FBI), Crime Laboratory Information System (CLIS), Drug Enforcement Administration (DEA), and American Society of Crime Laboratory Directors (ASCLD). Once compiled, letters and telephone calls to verify information having been completed, the list became the working "roster" for the project.

Participation was encouraged by assuring potential participants that all testing would be anonymous and confidential. Presentations were made by the Forensic Sciences Foundation by invitation at the National Symposium on Crime Laboratory Development in September 1974 at the FBI Academy, Quantico, Virginia and before the Criminalistics Section of the American Academy of Forensic Sciences Annual Meeting in February 1975. The Project Advisory Committee also addressed the International Association for Identification, the Association of Firearms and Toolmark Examiners and various regional professional associations. These presentations explained the nature of the project and answered questions regarding the design and administration of the testing procedure.

Throughout the course of the project, the number of laboratories on the roster was approximately 240. Additions and deletions from this list were made as the information regarding staff changes and opening and closing of facilities was forwarded to the project staff. The participating laboratories, located in the United States, its possessions and by special arrangement, Canada, were automatically included with no undue pressure imposed upon them if they chose not to participate.

TEST DESIGN

The task of designing the test structure for this project was primarily a responsibility of the Project Advisory Committee (PAC). Input was provided from the technical support personnel (CTS) pertaining to the type of data generated by a specific type of question and how that data might be best reduced, tabulated and presented. The Project Staff provided input regarding project procedures, the feasibility of packaging and mailing a particular sample, various packaging difficulties which might be encountered, as well as handling the processing of information germane to a particular sample. However, it was the PAC who established the test criteria, the sample criteria, generic categories of physical evidence to be used, sample specifications, the questions that would be asked pertaining to those samples, and an evaluation of the data presentation of the test results.

The initial meeting of the Project Advisory Committee (September 1974) addressed itself to establishing the essential criteria for conducting this project. A testing program of this type was new to the criminalistics laboratories (and viewed with skepticism), therefore, the PAC felt that the primary objective in the early stages was to encourage participation in what was structured as a completely voluntary program.

To meet the established goals, the following criteria were established for the design of the first ten samples. These same criteria subsequently were declared valid for twenty-one samples manufactured and distributed during the course of this project. These criteria were:

- Common, representative samples

  It was felt that samples should be common types of physical evidence routinely analyzed in the crime laboratory. While it was recognized that not all the laboratories were "full-service labs" in the sense that they were able to analyze all forms of evidence (i.e., drugs, firearms, trace evidence, etc.) it was felt that sample selection should be restricted to those areas which most laboratories would be capable of processing. As the testing progressed and became slightly more sophisticated, some physical evidence categories were selected, which admittedly, were applicable to only a limited number of laboratory facilities equipped for that specific type of analysis. However, these explorations of what may appear to be "uncommon" types of evidence were undertaken with specific objectives in mind, various problems had presented themselves that were best answered by encompassing these tests into the Proficiency Testing Program. Individual tests and the rationale for their selection are discussed in a subsequent section.

- Conductive to analysis by a wide range of testing techniques and procedures

  It was recognized by the PAC, as it is by the profession as a whole, that no standard methods exist for conducting an analysis and for arriving at a conclusion regarding any evidence type. This necessitated designing samples that would lend themselves to various modes of testing...that which would accommodate the examiner who had to rely on relatively simple methodology as well as the examiner with the opportunity to use sophisticated systems and instrumentation.

- Available in sufficient quantity

  To ensure fairness in testing, the samples selected had to be available in quantities sufficient for distribution to 240 laboratories. Also a vital part of this criterion was the "quality control" of the sample...not only must the quantity available be sufficient, but it needed also to be homogeneous to allow only minimal differences between samples sent to participants.

- Suitable for refereeing

  Again, to ensure fairness, the samples had to be selected from batch lots on a random basis for analysis by the referees. It would be impractical to design a sample wherein each unit (for subsequent distribution) had to be individually tested and analyzed. Tests had to be designed so that referee samples could be selected randomly from the general production of a sample, thus insuring that the referee laboratory received a representative sample, i.e., the same quality and quantity of material sent to all other participants.

- Straightforward samples containing no tricks

  To encourage participation at the outset of the project, the PAC chose to confine the samples to relatively straightforward selections. Since the confidence and participation of the laboratories was being sought, to prepare and distribute complicated or complex samples this early in the project would have been unwise. As the testing progressed, the samples became more complex and sophisticated as a means to further challenge the capabilities of the laboratories. An attempt was made to keep the samples realistic, but this proved to be one of the most difficult criteria to meet. Manufacturing procedures proved to be more complicated than originally thought, sample size determination was often a problem, and the need for maintaining quality control tended to result in "sterile" and not actually representative of the actual types of evidence entering a crime lab from a crime scene. For example, samples could not be contaminated with dirt, oil, etc., (as is often found in the laboratory) because of the difficulties in replicating such contamination. Generating samples of uniform size often required that samples be larger than those usually submitted to the laboratory for analysis from a crime scene.

Once the general criteria for testing were established, the PAC generated a "sample constituent list" (SCL) which consisted of candidate test sample categories which met the established criteria. Those which did not conform were removed and retained for future use, should the criteria employed for sample selection ever be altered or expanded. Items listed were from generic categories such as controlled substances, firearms, glass and paint, etc., not specific sample descriptions.

After the specific category for a test sample was selected, the Project Advisory Committee then discussed the specific test sample design. A set of Test Parameters and Sample Parameters was designed to structure this process. The sample (with few exceptions) had to meet all of the established parameters in each of the Test Class and Sample Class.

TEST PARAMETERS

The following were the Test Parameters used:

- Test Objectives

  The objectives and rationale for conducting this particular test had to be defined. "What is the sample designed to test, what information are we looking for etc.?"

- Realistic Laboratory Capability

  The main question asked was, "Does this test lie within the capabilities of most laboratories or does it represent too great or not enough of a challenge?" Also taken into account under this parameter was the amount of equipment required to process the sample, as well as the amount of examiner time (both bench and administrative) needed to complete the test. One must again point out that participation in this project was strictly on a voluntary basis, and the case load in virtually all crime laboratories was well known to be nearly overwhelming. If a test was sent out that required an inordinate amount of an examiner's time be taken away from his required duties, or tied up a vital piece of laboratory equipment so as to interfere with the routine function of that lab, it was felt that participation would drop markedly from a purely practical point of view. The test design had to adapt itself to the unique caseload problems and manpower shortages which are experienced by many laboratories.

Tests had to be structured so that an answer could be arrived at in several different ways, or by using any one or combination of different available methods. Small laboratories with limited instrumentation could not be excluded from participation because of the lack of sophisticated equipment; they would have to be able to arrive at a conclusion using the facilities and equipment available to them.

- Plausible scenarios

Short scenarios accompanied most samples as a device to better define the type of information requested because the depth of the examination performed on some of the evidence types might be dependent on defining the sample in the context of a case type situation. One of the instructions given to laboratories was that they should handle the test sample evidence in a manner similar to that used for actual case evidence submitted to that laboratory. A scenario served to define, to a greater extent, the nature of the evidence. The scenarios became more abbreviated as the laboratories became more familiar with the project.

The scenarios were also designed to elicit from those laboratories with restrictive reporting practices as much information as they were able to develop. For example, a laboratory may have developed more information in the course of testing a sample than either its reporting practice or state statute required. The scenarios, however, were desinged to elicit all information derived, not just that required by statute or operating procedure. This situation occurred primarily in the analysis of drugs, where, in some instances, laboratories are required to report only the drug of highest schedule found (either State or federal statute) or only the first drug identified which would be necessary to file on the charge. Other laboratories are required to fully report all identified controlled substances, while still others are required to report all the controlled substances and any diluents found. Some laboratories routinely quantify substances identified, though most do not.

By providing the examiner with a scenario which requested all information developed in the examination, it was hoped that more extensive data could be gathered. (See data sheets for Test Samples #6 and #15.)

- Number of samples per scenario

  The decision as to the number of samples which would comprise a given test involved judgment as to whether the test was to be a source comparison or a substance identification. In those tests where a comparison was being made (e.g., paint) the number of items to be compared had to be determined as well as the source of each of those items. Would all three components be the same, two the same or would all be different? Once established, it was necessary to determine the qualities by which the differing samples would vary from each other.

- Candidate questions

  The basic test objectives came into focus with the design of the test questions. Throughout the course of testing, several different modes of test questions were employed. These ranged from very broad and open ended, to fairly specific and defined. (See Sample Discussion, Data Sheets p. 32.) This is another indication that this project was indeed a research project; that it was necessary to experiment with different forms of documents to create the "ideal" questioning form; questions had to be designed in light of the information being sought and the specific test objectives. Input was necessary from those providing technical support as to the adaptability of the data generated by a specific type of questioning to reduction and tabulation, as well as the statistical validity of that generated data. The previous testing experience of the National Bureau of Standards and Collaborative Testing Services personnel was extremely useful in this regard. By drawing on their previous and on-going testing projects in areas such as paper, color and rubber, they were able to offer suggestions pertinent to the design and structure of test questions. Again, in this instance, the unique nature of the crime lab and its operation was illustrated by the fact that many standard questions used in other forms of testing did not lend themselves to the crime lab because quantitation is uncommon, testing is often comparative in nature for which it is difficult to prepare statistical presentations, and there is virtually no standardization of methods--a fact which other forms of testing rely on quite heavily.

The scope of work performed by a crime laboratory has to conform to the specific problem--in one case exclusion of a piece of evidence rather than an exact identification may be required. In another case, exact identification of the composition may be required to satisfy the law as written. Common origin determination is often what is sought, and this too sets the crime lab apart from other types of testing laboratories. No other proficiency testing program concerns itself with the possibility of common sources of test samples. These different approaches do not lend themselves to the type of testing that is carried out by most other types of "testing" laboratories wherein a set protocol for the examination of a given sample of anything must be followed. Lacking the uniformly applicable protocol and procedure, it became quite difficult to devise test questions that would be palatable to both the examiner of the evidence and the statistician who compiled the results.

SAMPLE PARAMETERS

Once the test parameters were established, it was then necessary to examine the items selected to be samples in light of the following considerations.

- Replication capabilities

  The sample had to be manufactured in such a manner as to ensure homogeneity. If produced in a batch lot (such as a drug), the methods which would assure homogeneity had to be specified. In cases of samples which had to be produced individually, such as firearms, a procedure had to be established for examining the products to ascertain they were all sufficiently alike and possessed the characteristics that had been specified. A sample that did not lend itself to replication in large quantities could not be used...all laboratories had to receive virtually identical samples to ensure validity of the test. Therefore, if a variation might alter the nature of the degree of difficulty of a sample, it could not be used. As an example, in an arson examination sample, if burned pieces of material were to be sent out for examination, the amount of burning, residue, etc., would have to be controlled carefully. The PAC considered this to be too difficult to control for the number of samples required and excluded it from the project.

- Physical makeup

  The makeup of the sample had to be ascertained in view of the subsequent packaging and mailing requirements. Various substances posed packaging problems such as locating suitable containers (as in the arson sample) others posed mailing problems, such as the controlled substances. The physical properties also affected scheduling the sample. If a quality of the sample selected could be altered by the passage of time, as is the case with blood, manufacture had to be scheduled fairly closely to mailing time to assure the value of the sample did not deteriorate. Also to be considered was the nature of the testing vis-a-vis the sample. If the sample required destructive testing rather than non destructive testing, an adjustment would have to be made in the amount sent to each participant. The intention, as stated in the initial project plans, was that the remaining portion of each test sample could be retained by the laboratories and used as shelf reference materials, since they would receive a complete report of its composition. This, while feasible in some cases, was unrealistic in others.

- Packaging and mailing requirements

  As noted above, the packaging for each individual sample depended on the sample's physical makeup and "life". The manner in which sample components (in the case of multiple samples per test) would be identified (marking or labelling, depending on the nature of the sample) had to be determined as well as specifying the wrapping or packaging which would be used for each of those individual components. Also to be taken into consideration was the method of handling the sample to avoid accidental contamination or destruction. Once these requirements were defined and specified, it was the task of the project staff to see that they were carried out. The pitfalls of conducting testing of this sort for the first time were evident in this step in the process. In several cases the packaging proved to be inadequate or the container proved to be less durable than had been expected. In cases where necessary, special methods of operation (such as using certified, return receipt mail, air mail, etc.) were employed.

  A special project logo was designed to ensure easy recognition of the parcels and letters pertaining to the project. All correspondence pertaining to the project carried the distinctive "target" in red and black. (Figure 5.)

The mailing procedures employed for the distribution of samples underwent marked changes during the course of the project. These are described in detail in the section covering sample mailing.

- Manufacture availability

  The expertise of the Project Advisory Committee particularly the PAC member designated as the Manufacture Agent, was relied on to determine if a sample could be manufactured according to specifications. Following that determination, the procedure for the actual manufacture of the samples was implemented. (See sample manufacture section.)

- Cost/Time factors

  The final consideration in the selection of a substance or an item to be a test sample was the relative cost of preparing that sample and the amount of time the production would take. It would have been impractical to arrange for the production of a sample which required an inordinate amount of time and equipment to facilitate manufacture. The time required to examine the samples for homogeneity and specificity had to be taken into consideration as well. Through the experience acquired during the course of the project most of the samples selected readily lay within the bounds of reasonable time and cost considerations.

DESIGN TEST QUESTIONS

Following the selection of a sample type and the determination of the specific nature of the material to be used, the test questions were discussed. As stated previously, the questions basically followed one of two formats; either open ended, broad questions or objective type questions. The PAC, along with the project Staff and CTS would draft the language which was to be employed in these questions.

Sample Manufacturing Procedure

Once the criteria for a specific sample were established, it became necessary to restrict knowledge of those criteria, as well as the answers to the questions posed in the data sheet, to as few individuals as possible to avoid compromising the test. The original sample manufacturing procedure specified in the grant proposal (for grant #76-NI-99-0048) outlined a fairly complicated procedure in which potential manufacturers would be invited to bid for the contract to manufacture the sample. This procedure, while conforming to the guidelines used by the Federal government in contract bids for large items, proved to be unusable for a project as unique as this. Firstly, the number of items which required production was relatively small as the roster consisted of approximately 240 laboratories, and secondly, the samples to be manufactured did not fall into any established descriptions. The process was explored and attempted in part, if not exactly as written. Unfortunately, the results of this experiment were virtually disastrous, requiring that the entire procedure be changed. This was reflected in the grant proposal for the continuation of the project.

After the Project Advisory Committee held its first meeting, it was decided that, in the interest of expediting the production of the first sample, the prescribed manufacturing process would be abbreviated, in light of the fact that several potential manufacturers offered to provide sample materials at no cost.

The sample selected was amphetamine. Since relatively few pharmaceutical concerns manufacture this substance, direct contact with one of these concerns, rather than requesting bids, would be advisable. Also, the total quantity of the substance required to prepare enough samples for all participants was quite small, suggesting that no potential bidder would be interested.

A major drug company was contacted and apprised of the requirements. They offered to provide adequate material to the project at no cost and the offer was accepted by the Project Advisory Committee.

Unknown to the PAC, Staff and NBS, that same manufacturer had provided a quantity of the same controlled substance to the National Institute on Drug Abuse located in the same building as the Forensic Sciences

Foundation offices in Rockville, Maryland. The information regarding the material provided to NIDA was not "secret", and within a matter of weeks many individuals knew that the substances were the same. Test Sample #1 had mistakenly been compromised before it was mailed to the participating laboratories. A new sample had to be manufactured.

As a result of an emergency meeting of the Project Advisory Committee, the new procedure for manufacturing, which stated that the responsibility be turned over to a member of the PAC, was established...thus materially reducing the possibility of "leaks". The committee member was then able to draw from the professional resources available to him in his capacity as a criminalistics authority. Arrangements with commercial establishments were made based upon an expressed desire to participate or a previously demonstrated ability to produce samples of this type to conform to the specifications required. The PAC member was also free to engage the services of another laboratory, or professional organization to assist in the manufacturing process.

Although the compromise of the first sample was an unfortunate coincidence rather than the fault of any particular individual, it served to illustrate some of the unanticipated problems which would continually arise if the manufacturing process were to be followed as originally proposed. The change to PAC responsibility for manufacturing proved to be effective, not only from the standpoint of guaranteeing the secrecy of the composition of the sample, but in circumventing other problems which would have arisen because of industry's unfamiliarity with the unique problems dealt with in the criminalistics laboratory.

An unforseen benefit of the procedural change was the reduction in cost of the preparation of the samples. In the initial grant proposal, $2,000 per sample had been allocated for manufacture. Under the revised procedure, manufacturing costs were reduced markedly. Manufacturers contacted by the PAC members often were willing to provide samples at no cost, and where costs did occur, they were nominal.

Through contact with members of the criminalistics profession actually participating in the project, it became apparent that there was an additional advantage to having a member of the profession directly involved in the manufacture of the samples. By having a fellow member of the profession directly involved, the participants felt the samples would be produced fairly and with the workings of the criminalistics laboratory in clear perspective and this reduced some of the skepticism about the project and encouraged participation.

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Throughout the course of the project, the problems presented in manufacturing were constantly underestimated. Every sample had problems, whether it was not being able to locate the test materials decided upon, or achieving the realism intended. Logistical problems presented themselves, which on occasion, necessitated a change in the sample. As an example, it was difficult for the laboratories to accept the intended realism of an auto paint (Test Sample #5) that was presented uniformly spread on a metal backing, but manufacture and distribution any other way would have been impractical. Ideally, taking scrapings off a car might have been more realistic; however, the quality control problem of ensuring that each laboratory received the same quantity and quality of sample precluded that approach. Homogeneity of samples was a factor which constantly had to be closely monitored. In the case of the headlight glass (Test Sample #9), to insure that all laboratories were receiving the same samples, only one lens was used. This proved to be logistically difficult as it was virtually impossible to break one headlight lens into 240 uniform size pieces. To remedy this, the lens was sawed, which left striation marks from the saw on the glass, created uniform size cube shaped pieces of glass, but destroyed the intended realism. No crime lab receives a smashed headlight in uniform size cubes.

Occasionally minor errors were made in marking, packaging or sample question design. However, none of the samples was ever erroneously described, that is, nothing was sent out which was not what it was supposed to have been. In any proficiency testing program, the conformity of the manufacturer's product to designed specification is a major activity and often beset with problems. However, it is felt that in spite of the problems cited (many of which are present in other on-going proficiency testing projects), the overall products were remarkably good.

It is recognized, and should be noted here, that if testing of this type continued on a similar scale or be enlarged in any way, the method for manufacturing which evolved from this first effort would probably be continued with modifications. PAC responsibility for manufacture required many man hours of volunteer time contributed by each member of the committee. This was done in an effort to see this project succeed as a prototype for future testing. It would be unreasonable to expect these or other individuals, all of whom have many other responsibilities in their professional capacities, to continue to extend the same amount of volunteer time in the future without compensation. However, after making changes as a result of the experience gained by manufacturing twenty-one different samples, it is believed that some of the problems initially encountered, could be avoided.

In a peer evaluation study of the project conducted by the Foundation (See p. 42.), a recurring criticism in the midst of high praise was that the samples lacked realism and were not truly representative of actual case materials. While the PAC recognizes this as previously stated, it is extremely difficult to replicate what amounts to a case type situation while maintaining homogeneity amongst a large number of samples. However, the samples, along with the accompanying scenarios, did in fact present a plausible package.

Design of Test Questions

After arranging for the manufacture of a particular sample, the PAC addressed itself to the formulation of the questions which would accompany the sample. While candidate questions had been discussed during the test and sample parameter phases, it was now necessary to formulate the actual wording and format which would comprise the data sheet. This document, the data sheet, went through an evolution of its own during the course of the project.

In the early stages of the project, NBS was a strong proponent of questions which would produce quantitative answers and a great deal of numerical data. The highly sophisticated forms of testing being carried out at the Bureau lent themselves easily to this type of quantitative analysis and statistical presentation. However, the nature of the testing being carried out in this project did not.

The generation of many statistically oriented charts and graphs which result from quantitatively oriented questions and standardized laboratory procedures were felt to be too ambitious for a testing program in its very early stages and not fully applicable to the various types of evidence encountered in the crime lab.

Since the initial goal of encouraging participation had been established and samples were being designed as "results oriented"; that is, the greater interest was in the answer rather than how it was arrived at, it was decided that the questionnaires would be worded in an open ended fashion. What was sought was any kind of information the laboratory ordinarily would develop in the analysis of the same type of evidence. A persuading argument in the decision not to ask detailed questions was that the more specific the requests were concerning protocol, the more hesitant the laboratories might be to participate. Since the sensitive issue of standardization of laboratory methods and procedures (or lack of it) was also a consideration, it was thought that detailed requests for information might leave the impression with participants that proficiency testing was to become synonymous with standardization, which was not the case.

Whenever categories were repeated, more specific information (when it was felt to be appropriate) was requested. Data sheets were reconstructed in a more objective manner allowing the respondent to indicate his findings by checking the appropriate answer. The same treatment was also given to the methods section of the data sheet (where appropriate; see Test Sample #10A, Paint) and, in addition, examiners were asked to indicate the sequence of tests they performed and the point at which a decision regarding the conclusion was reached. While this proved to be useful in some cases, it was not uniformly applicable. Each time a new category of physical evidence was incorporated into the project, the questions again became of the open-ended variety.

Again in this phase of operation, because this was a project to explore how to conduct this type of testing, unforseen problems arose. Some questions were too vague--some respondents had difficulty in discerning exactly what was being asked--others overstepped the bounds in which the criminalist functions. For example, in Arson Examination, Test Sample #14, a question was included referring to any evidence of conspiracy. The purpose of the question was to determine if one aspect of physical evidence could be related to another, in this instance a physical match between two pieces of cloth. The question as posed was poorly phrased and one that would be inappropriate for a criminalist to answer if asked in court; therefore, it did not belong in the test and responses to it were not tabulated.

Since the tests remained geared to producing results, the various types of questioning used proved to be successful. While some who have been involved in other testing programs outside criminalistics might criticize the data collected as being quantitatively insufficient, the Project Advisory Committee clearly feels that the questioning was proper and the results support this view when the distinct nature and function of the laboratories is considered.

TEST EXECUTION

Following the design and preparation of the sample, the next phase to be accomplished was the test execution, a task which was primarily assigned to the project staff. There was constant close coordination between project staff and PAC to effect the test execution within the timeframe set up. (See Figure 6.) Unforseen obstacles discussed above caused delays in the schedule established for the production and mailing of the samples necessitating changes in the order of samples on occasion or delaying the distribution on other occasions.

FIGURE 6

MANUFACTURE DELIVERY DATE	M-20
DATE SAMPLE MAILED	M-DAY
ALERT POST CARD	M+20
CUT-OFF/QUICK REPORT	M+35
DRAFT ANALYSIS	M+55
FINAL REPORT MAILING	M+75-85

Assignment of Code Numbers

To ensure the confidentiality and anonymity of the laboratories in this project (that being the basis for participation and fundamental understanding in a voluntary research project of this sort),a system of identifying the laboratories by a randomly assigned code number was established.

The most crucial issue that was addressed, and upon which the success or failure of the project was based, was that of confidentiality of data and complete anonymity of participating laboratories. The need for these conditions could not be overemphasized, and time and time again was reiterated in the initial concept paper, the grant proposal, the grant award, the correspondence with participating laboratories, the project reports, the deliberations during Project Advisory Committee meetings, as well as the language in the continuation grant under which the project is currently operating. Both LEAA and the Foundation were aware that without the promise of confidentiality and anonymity written into the grant, laboratory participation would be negligible.

To this end, two special conditions were written into the Grant Award. (See Chapter I , page 8.)

It was emphatically clear that the reasons the project was funded and the data gathered were solely for research and statistical purposes.

After being convinced by the Project Advisory Committee (PAC) and the staff of the Foundation that anonymity and confidentiality would be guaranteed and that the principal thrust of the project would be to benefit the laboratories by giving them insight into their own proficiencies, and allow them to compare and contrast their procedures and capabilities with other laboratories around the country, most crime laboratories decided to participate.

After the mailing roster had been compiled and revised, laboratories were assigned a "code" number. The numbers for this "code" were drawn from the Rand list of random numbers. The prefix (letter) preceding the assigned number (A series, B series) was not an integral part of the code.

Laboratory Directors were given their assigned code numbers and advised to limit the knowledge of that number to as few individuals as possible. To further protect the anonymity and confidentiality of the participants, code numbers were assigned for tests 1-10, reassigned for 11-15 and then again for samples #16, 17, 18, 19, 20 and 21, bringing the total number of codes assigned to a given laboratory to eight.

Following completion of the data reduction and analysis, the Foundation's record of code numbers was returned to the respective laboratory directors. In this manner, the key to identifying the performance of any particular laboratory remained with the director of that laboratory, and thereby ensured the Foundation's promise to participants that testing would be anonymous.

In retrospect, the PAC feels that the use of code numbers did not serve the purposes of the project well. The problems that could have and did arise from the maintenance of such a list were not balanced by their usefulness as a record keeping device. In future testing of this sort, code numbers would not be utilized in order to guarantee complete anonymity and confidentiality to participants.

Packaging and Mailing

Following the preparation of the test samples by a member of the Project Advisory Committee according to specifications set forth, the items were prepared for distribution to participants.

The type of wrappings and containers used for each sample were determined at the time of the discussion of the sample specifications. The project staff then located the proper packaging materials and containers. An effort was made, wherever possible, to find packaging materials which would be suitable for storing the remaining durable samples as shelf reference materials, if so desired by the participants. Tamper-proof evidence tape produced by the 3-M Company was used to seal the packages to impart authenticity, and all packages were marked with the easily recognizable project logo.

The wrapped sample was then placed in a protective mailer of the cushioned type to protect the samples from the rigors of travelling through the U.S. mail system.

While most samples arrived at their destination intact, there were several instances when packaging was inadequate. In one instance, poor packaging caused the cancellation of the test. Specifically, in Test Sample #10, housepaints were drawn on glass plates, scraped and a predetermined quantity of the scrapings were placed in a glassine bag. In this instance, the bags were improperly folded, allowing the paint chips to escape into the plastic box which enclosed the bag. This presented the possibility of the three different samples contained in the same box cross contaminating each other. Since it could not be determined whether this had happened, the test had to be cancelled and the entire process repeated.

All items which comprised the test were labelled by an "Item" designation dependent on the total number of samples which comprise the test. If there were three pieces of "evidence" to be examined, items would be labelled A, B and C. Labelling was uniform (except in the firearms examinations); like items were assigned the same letter. The Item A sent to any one laboratory was the same material as the Item A sent to another laboratory. The exception to this procedure was firearms examination, in which bullets and cartridge cases were marked in "batch lots", so that a particular item was assigned several sets of letters and responses could be categorized based on the particular letters reported by respondants. In this manner, with so many different letters in use, it was not necessary to retain records of which letter items were sent to any particular laboratory. A description along with item marking would characterize the sample sufficiently.

The package included the documents which accompanied the sample--the covering letter, an instruction sheet and a data sheet with the code number assigned to that particular laboratory on it. The cover letter itemized the contents of the package, an indication of the closing date for the test, and any special information which pertained to that test. The instruction sheet contained specific information pertaining to examination and reporting requirements, and the data sheet contained the actual scenario and questions asked. Also enclosed was a postage paid return envelope for the submission of data.

Mailing

The mailing procedure was an operation that underwent considerable change from the mechanism originally described in the proposal for the original grant. The first item to be discussed concerning mailing is the development of the mailing roster. As previously stated, various sources were used to develop the list of participants including LEAA, the FBI, DEA, etc. Other sources were the National Library of Medicine survey of toxicology laboratories, various regional association rosters, --in short any laboratory that seemed to be a plausible candidate for inclusion in this proficiency testing project was included. Addresses, telephone numbers as well as the name and title of the director were verified.

This roster, after several revisions, was put into a format suitable for xerox reproduction and label generation. At a later date, the list was computerized and the roster, updates and labels were processed in the computer. The only information contained in this roster was the laboratory name, director's name and address. No information regarding code numbers, laboratory capabilities or performance were at any time part of this roster. Its function was to expedite mailings of Test Samples and report. (This roster is attached at Appendix A.)

At the outset of the project, the mailing procedures employed were so used to assure all possible precautions and safeguards were being taken to ensure that samples arrived at their destination. To notify laboratories the sample would be coming, an alert letter was sent to recipients approximately five days before the sample was to be mailed. Packages were mailed from the Foundation office in Rockville, Maryland using first class, certified, return receipt request mail. Five days after the package was sent, a letter followed stating the package had in fact been sent, and the Foundation was to be advised if it had not been received. Several problems arose with this procedure, causing the project staff to modify it as needed, resulting in a marked simplification. It was reported by many laboratories that the alert letter sent prior to the sample was arriving at the same time as the sample package, thus negating the intent of the alert letter. Using first class, certified return receipt mail to ensure delivery also turned out to be useless. In many instances, the return receipt cards never found their way back to the Foundation office, even though through investigation it was ascertained that the package had indeed been delivered. If it were determined that a package had been lost, the post office did little or nothing to locate or trace it. Therefore, the added expense and effort (in terms of extra postal fees and record keeping, etc.) to send the packages in this manner was fruitless. As a result, packages were simply sent by first class mail. The overall loss rate remained the same.

The follow up letter was retained since it became the only means by which the project staff could ascertain whether the packages had been delivered. The letter included instructions to notify the Foundation office if the parcel had not arrived, or had arrived in a condition which was damaged or destroyed. In these cases the samples were replaced.

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The mailing problems remained constant throughout the course of the project. Other parcel carriers (United Parcel Service) were considered, but since their delivery areas did not reach the entire country, this proved to be unusable. Although packaging and mailing were under full control of the project staff for those operations conducted at the Foundation offices, there were instances where samples ran into difficulties because of conditions which were outside project staff control. For example, a blood sample was distributed in the summer months during what was a particularly warm period for the entire nation. Several complaints were received that the sample had arrived at its destination in a putrified state. After checking temperatures across the country for that time, it was found that most areas of the country were experiencing daytime temperatures in the ninety degree range, and not being able to trace the specific route of any package it was not inconceivable that several of the packages had been subjected to temperatures while in transit (particularly in a closed truck) which might in fact have altered them in some way. So, although the packaging and mailing were done under controlled conditions, once the packages had left the Foundation office there was little that could be done to circumvent unforseen occurrences such as those previously described.

Referee Laboratories

The original grant proposal stated that the purpose of using the Referee Laboratory procedure would be to ensure that as close to a "true" value possible was obtained for each test sample used in the project. Also stated was the intention that participating laboratories not be used as referees. This in practice was impractical if not impossible, for virtually all the laboratories with the necessary capabilities and understanding of the particular problems addressed in the testing were participants.

Referee laboratories were selected in two different manners--first laboratories with reputations for excellence in a particular area of testing were singled out by the PAC and requested to analyze the materials to be sent to all laboratories. There was sufficient reason to believe these laboratories would work the cases in a complete and accurate manner. In the second mode, applicable only to multiple iterations of test categories, laboratories were selected who had submitted data that indicated the capability to perform above average analysis in that particular field. Generally, three laboratories were contacted to serve as referees for a particular test sample; however, not all those who originally agreed to act as referees submitted data, bringing the number of referees for any given test from three to none. In effect, for some tests there were no results from referee laboratories.

In the Proficiency Testing Project, as it was conducted, referees did not serve in the "classical referee" capacity. Because of time constraints in both the manufacturing procedure and the time allowed for participant response, the results reported by those laboratories selected to serve as referees generally could not be reviewed before the sample was mailed to all participants. This precluded the opportunity to make any changes in the sample design based on the referee findings. Often, the referee results came in at the conclusion of the test period along with the other participant data.

Another factor which minimized the usefulness of the referee laboratories as used in this project was that there exists no uniformity of methods employed in examining any particular class of physical evidence; therefore, the entire range of methods reported by participating laboratories was not necessarily covered by the methods reported by the referee laboratories. In addition, much of the testing is comparative in nature and does not require the determination of absolute values to arrive at a conclusion.

While it is recognized that the referee procedure as employed in this project was inadequate, it is felt that the procedure (encompassing manufacturing and mailing alterations) could be adapted to work well within such a testing system. Additional lead time is needed for manufacture of samples and an adequate period of time need be allowed for the referees to examine the samples before they are mailed to the participants. This procedure would allow necessary changes in mailing and packaging materials and accompanying documents to be made. As the project was structured, there was insufficient time between the manufacture and general mailing to accomplish this. The Project Advisory Committee feels that in any continuation of proficiency testing, the timetable should be modified to allow for adequate refereeing of the samples prior to general distribution.

Response and Records

The package sent to participants contained, as previously stated, a cover letter, an instruction sheet, a data sheet and a return envelope. For purposes of recordkeeping, laboratories were assigned a code number to enable the project staff to properly process the responses submitted.

The appropriate code number for a particular test was placed in the upper right hand corner of the data sheet and the respondent was asked to check it against the assigned code sent under separate cover.

A list was kept (by code number) of those laboratories that were sent a particular sample, whether a response was received, and whether that laboratory stated they did not have the capability to process that particular sample. In this way, a tabulation of the response rates for statistical purposes could be made. The participation rate was calculated as follows:

$$\frac{\text{Number of Responses with Data}}{\text{Total Number of Samples Sent} - \text{Number of "Do Not Do" Sample Replies}} \times 100 = \text{Participation rate (\%)}$$

A record of participation was kept for each laboratory. This was a listing by laboratory name, with no accompanying code numbers, kept for purposes of tabulating responses on a geographical basis and for ascertaining capabilities in particular areas of evidence examination. This became particularly important in those instances where the samples required complicated manufacturing procedures, such as questioned documents and firearms. If the total number of samples to be produced could be reduced by reviewing the records pertaining to capabilities that was compiled, and those laboratories lacking the ability to process that type of evidence eliminated, manufacturing time and costs, as well as mailing time and costs, could be reduced.

After the receipt of all responses following the cut-off date, the data sheets were turned over to the Collaborative Testing Services, Inc. All identifying items which might have been placed on any data sheet (signatures, laboratory time stamps etc.) were removed prior to being turned over to CTS.

As stated, one of the basic goals of the project was to conduct research into how to perform a project of this nature, therefore, following the tabulation of the collected data, the code numbers were returned to the respective laboratories leaving the project staff with only aggregate lists of numbers. The records contained lists of numbers assigned to a particular laboratory during the course of testing, but there remained no link between a laboratory name and any numbers. As a result, the project collected participation data (in terms of whether a laboratory had responded, but no information regarding the content of the response) by name, and technical response (data) by number, with no accompanying names. It was felt that in this manner the necessary data would be retained in a manner most useful to all involved...the laboratories would be guaranteed the anonymity and confidentiality promised to them at the outset of the project, and the project staff and the PAC would have the data needed to evaluate the project in the perspective of the stated goals.

Alert Post Card

To encourage timely responses, an "alert post card" was sent to those laboratories who had been sent samples but had not yet returned their data prior to the cut-off date for the return of data. It was noted that this post card caused an influx of responses, at least toward the end of the stated examination period. Many more responses were received by the project staff following the mailing of these cards.

TEST STATISTICS

Data Reduction

Upon completion of the testing period, all data sheets submitted were turned over to Collaborative Testing Services, Inc. for data reduction and report preparation.

Information compiled was a summary of the referee responses, the manufacturer's statements, as well as a summary of the responses submitted by all participating laboratories.

Among the technical tasks completed were compilation of a summary of methods reported used, instruments used (if applicable), the point at which a decision was reached (again, if applicable) and calculation of pertinent percentages. Any appropriate charts and graphs of the reported results were drawn up and included in the draft of the Test Sample report.

Data reduction was accomplished manually, as the materials did not easily lend themselves to computer reduction. The wide range of reporting policies, methods used, and the Project Advisory Committee's decision to use the open ended form of questioning were in part responsible for the continued need for manual data reduction.

TEST EVALUATION

Quick Report

Following the cut-off date for the return of data, a quick report was sent to all laboratories who had submitted data for that test. The quick report consisted of the manufacturers statement of description of the sample and its contents. This was done to allow laboratories to rapidly judge their results against the manufacturer's description without having to wait for the final report of a particular test sample to be distributed.

Test Sample Reports

The completed draft test report, prepared by CTS was then distributed to the PAC for comment and criticism. Following the critique, the recommended changes in the report were made. Test reports were prepared for printing by the Project Staff. When completed, individual test reports were distributed to participating laboratories and the project grant monitor at LEAA.

PROJECT EVALUATION

Background

To assess the success of the project, per se, an evaluation questionnaire was distributed to all participating laboratories. This was done following the "first phase" of the project by which time 5 different classes of physical evidence had been distributed twice.

During that period the samples were distributed to approximately 240 laboratories. (Some laboratories did not routinely examine some of the classes of evidence used in the test.) At the conclusion of the tenth test, an evaluation questionnaire was distributed to all the laboratories on the project rolls. This report of the results covers the ratings given by 144 laboratories--representing a response rate of 60%--whose evaluations arrived in time to be included in the tabulation.*

Numerical Results and Computation Procedure

Following is a numerical tabulation of the results of the responses, together with the computation procedures used to prepare the numerical tabulation of responses.

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*5 additional laboratories submitted evaluation after the cutoff date and are not included in the tabulation. However, in interest of reporting the true response rate to this survey, these untabulated responses would increase the total response rate to 62%.

TABLE 1

NUMERICAL TABULATION OF RESPONSES*

QUESTIONS	SIZE PROFESSIONAL STAFF				OVERALL RATING
	1-4	5-9	10-19	20+	
#1: Rate the Choice of Categories	(66 Labs)	(35 Labs)	(30 Labs)	(13 Labs)	(144 Total)
a. Controlled Sub.	3 0	3.1	3.0	3.1	3.0
b. Firearms	3.0	2.9	2.9	3.0	2.9
c. Blood	2.9	2.8	2.8	3.0	2.8
d. Glass	3.0	2.7	2.6	3.1	2.8
e. Paint	2.8	2.9	2.8	2.8	2.8
#2: Rate Physical Characteristics					
a. Quantity	3.2	2.7	2.7	2.6	2.8
b. Quality	3.1	2.8	2.5	2.7	2.7
#3: Rate Data Sheet	2.5	2.2	2.3	2.7	2.4
#4: Rate Statistical Reports	3.2	2.5	2.7	2.8	2.8
#5: Rate Test Administration	3.2	2.8	3.1	3.1	3.0
#6: Overall Rating	3.1	2.7	2.8	3.4	3.0
#7: How Often Test 30 days	13	12	6	4	35
45 days	11	8	4	3	26
60 days	37	18	16	6	77

Rating Scale: 4 = Excellent 3 = Very Good 2 = Good 1 = Fair 0 = Poor

*An explanation of the computation procedure begins on page 4 5 .

Conclusions

The laboratories with the smallest (1-4) and the largest (20+) staffs of physical evidence examiners tended to rate each question higher than the laboratories with staffs of 5-9 and 10-19. The reasons for this variance are unknown.

The major reasons cited for the relatively low ratings given to Question #2 were:

(1) Samples are too big

(2) Samples lack realism

It was assumed that the low rating assigned to the Data Sheets stems from the errors made in structuring the earlier test forms.

There was, however, a constant tug-of-war going on re: Data Sheets. Some wanted them to be much more explicit. Others wanted them to be completely open ended.

It was evident that the rate of testing had to be decreased to, at most, one test per 45 days.

COMPUTATION PROCEDURE

STEP 1 Laboratory Characteristics

In an effort to ascertain if laboratory characteristics (size, population served, services offered) played a significant part in the evaluation ratings, the laboratories were grouped according to the reported number of persons examining physical evidence versus the reported population served. Following is the result of that tabulation.

Number of Laboratories by Staff Size and Population Served

Nr. of Persons Examining Physical Evidence In Lab	Population Served*				TOTAL
	<100,000	100,00 to 499,99	500,000 to 999,999	1,000,000>	
1-4	6	25	25	10	66
5-9		4	13	18	35
10-19	1	0	5	24	30
20>	0	0	1	12	13

*Not all reports cited staff size or population served

Note that, with the exception of the large number of small staffs that reported serving large populations, there is a direct correlation between the size of the staff and the population served. Accordingly, the tabulation of the results of the survey was made on the basis of the number of evidence examiners employed by the reporting laboratory.

Sixteen laboratories indicated that they perform only drug, blood, or firearms examinations (or a combination of two). There was no significant variance in their ratings from those of full service laboratories. Eight of the 16 laboratories serve populations in excess of 1,000,000 but there was no significant concentration of them in any of the cells in the table.

STEP 2. Quantification of Ratings

Because of the difficulty associated with averaging qualitative answers (Excellent--Very Good, etc.) each such rating was reduced to a numerical value as follows:

Excellent	Very Good	Good	Fair	Poor
4	3	2	1	0

STEP 3. Numerical Computation of Answers

A. The number of responders for each question was first tallied as showing in the following example for Question #1 - Controlled Substance (as rated by the laboratories with 1-4 examiners.

Rating Offered in the Questionnaire

Size Lab	Excell.	Very Good	Good	Fair	Poor
1-4	18	31	13	1	0

B. The numerical value for each rating was substituted for the word values and multiplied by the corresponding number of responders.

Rating Values

Size Lab	Excellent 4	Very Good 3	Good 2	Fair 1	Poor 0	TOTAL VALUE
1-4	72	93	26	1	0	192

C. The Total Value was then divided by the total number of responders --producing an average value:

192 divided by 63 = 3.0 (equivalent to "Very Good")

SUMMARY OF COMMENTS*

I DATA SHEETS/DATA ANALYSIS/REPORTS

- In the test reports, more "in-depth" analysis is needed.
- Verified values for all relevant examinations should be included as well as graphic representation of participating laboratory results, whenever appropriate.
- The program should allow each laboratory to critically evaluate its procedures and identification criteria.
- Compiling of data has not always taken into account the limitations of the comparison process.
- Repetitious questions have been included on data sheets.
- Complete analytical procedures used by referees should be included in reports.
- On occassion, serology nomenclature has not been good - use of NIH recommended nomenclature would have been better.
- Data sheets (particularly the more recent ones) have been helpful in widening knowledge of the scope of tests performed on various samples by different laboratories.
- Some analysts would prefer to record their observations and conclusions on the data sheets as the tests are run rather than summarize them later.
- Data sheet should include a question as to whether the analyst knew it was a proficiency test.
- Some questions on data sheet are not possible to answer.

II PERSONNEL/EQUIPMENT TRAINING

- Test results should provide fuel for personnel and equipment requests for lab administrators...at budget time.
- The reports point out areas where increased training is needed.
- An individual's experience in the use of specific techniques to examine test samples should be correlated with his results.

* Accolades to the project were greatly appreciated but were not included in this summary.

- Results should be used to encourage adequate education and training programs throughout the country. The reports show there is a vital need for practical education as well as the need for continuing education to keep current with new developments and technology.

- There should be a review of the college/university programs for Criminalistics to determine what background is being taught.

III SAMPLE PACKING, CHOICE, SIZE

- In two cases there have been problems with sample packaging--breakage, cross contamination.

- Sample quantities were reported as being both too large or too small for a given test.

- Drugs--choose something more obscure.

- Request for samples in Toxicology.

- Include a non-controlled substance in a drug sample.

- Poor quality of one blood sample produced weak results.

- Samples not satisfactory for placement in routine case work. Therefore, more than routine work done.

- Samples concentrated too heavily on micro-chemical area of laboratory.

- Samples should be more consistent with real cases submitted by police agencies.

- Obtain drug samples from DEA seizures.

- Headlight lens specimens should be obtained by smashing...not cutting.

- Paint samples should be obtained from old buildings or cars.

- Almost all samples routinely received in the lab are contaminated. Why not contaminate proficiency samples?

- Several categories of testing should be included in one sample, e.g., blood on paint.

- Some samples too easy - others too difficult.

IV METHODS/ERRORS

- Some correct responses were obtained by laboratories without sufficient analytical data to support conclusions.
- Program would be more helpful if definite conclusions were drawn as to "good, better, best" technique to use on any given test.
- The summary should include the number of labs that were in error.
- What controls and standards were used in the manufacture and in the referee testing for each test?
- Labs should include a brief explanation of methods (particularly non-instrumental) and techniques used.
- Evaluations of methods and suggested references would be useful.
- Specific methods should be recommended for use to examine the evidence. It is difficult to evaluate results without use of uniform methods.
- Tables showing correlation between method and success would be useful.
- Project should evaluate methods that have been thought by the profession to be standard for a given type of physical evidence.
- The project should publish a compendium of methods used by participating labs.

V CODE NUMBERS/ANONYMITY

- Assignments of code numbers and publishing responses by code number jeopardizes anonymity of responses.

VI SAMPLE FREQUENCY

- The case load in laboratory is too heavy to devote as much time to proficiency testing as desired.
- Samples are submitted too close together.

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CHAPTER III

TEST SAMPLE DISCUSSION

INTRODUCTION

This chapter is a summary of the various test samples which were manufactured, distributed and examined during this research study. Because the selection and preparation of samples constituted one of the most challenging and problemmatical components of the project, it is important to detail how the test samples were obtained and/or manufactured, the structure of the data sheets which accompanied the samples to the participating laboratories and on which they recorded their results, a discussion of any problems which the manufacturer experienced during sample preparation and, lastly, a summary of the results and methods reported by laboratories in the examination of each test sample.

The chapter is arranged sample by sample, beginning with Test Sample #1 - Controlled Substance. Each sample discussion is broken down as follows:

- Data Sheet
- Manufacturer's Specifications and Discussion
- Summary of Results and Methods Reported

PROFICIENCY TESTING

FIGURE 7

CONTROLLED SUBSTANCE

Lab Code A-__________________

PROFICIENCY TESTING PROGRAM

TEST NO. 1

Examine according to your normal laboratory procedures and complete portion(s) below which complies with your laboratory policy.

1. (a) What is the controlled (narcotic or dangerous drug) substance____

   (b) Indicate method(s) used.

2. (a) Please add any other data (quantitative -qualitative) that you routinely develop.

   (b) Indicate method(s) used.

IMPORTANT

DO NOT SIGN THIS DATA SHEET OR IN ANY OTHER WAY IDENTIFY YOUR LABORATORY.

RETURN COPY TO: KENNETH S. FIELD, FORENSIC SCIENCES FOUNDATION, SUITE 515, 11400 ROCKVILLE PIKE, ROCKVILLE, MARYLAND 20852.

The manufacturer characterizes Test Sample #1 as being the controlled (Narcotic or dangerous drug) substance was PENTOBARBITAL. According to the manufacturer the sample is a blend with a nominal value of 74% SODIUM PENTOBARBITAL. Results submitted by two Referee Laboratories have an average value of 71% Sodium Pentobarbital.

This first drug sample was to be a controlled substance of sufficient concentration and amount to ensure a reply from the laboratory as well as provide what could be used as a shelf reference material following the test. The material was obtained from a commercial manufacturer and approximately one gram was supplied to each participant. Containers for packaging were submitted to the project staff for packaging at the Foundation offices.

TABLE 2

CONTROLLED (NARCOTIC OR DANGEROUS DRUG) SUBSTANCE FOUND

Part I of this table names the drug found as the laboratory would normally report it. If more than one name was used in answer to question la, the more descriptive name was counted in Part I. Drug reporting may involve state law, laboratory procedure, or reporter's discretion. Part II names the drug as actually identified.

Reported name of substance	Part I As normally reported		Part II As actually identified	
	number of labs reporting	percentage of total labs reporting	number of labs reporting	percentage of total labs reporting
1. barbiturate	8	4%	5	2.5%
2. barbituric acid derivative	15	7.5	8	4
3. pentobarbital 5-ethyl-5(1-methylbutyl) barbituric acid	136	68	138	69
4. soluble pentobarbital salt of pentobarbital	4	2	4	2
5. sodium pentobarbital pentobarbital sodium	24	12	30	15
6. amobarbital	2	1	3	1.5
7. butabarbital	4	2	4	2
8. secobarbital	2	1	2	1
9. phenobarbital	1	.5	1	.5
10. sodium butabarbital	1	.5	1	.5
11. sodium secobarbital	1	.5	2	1
*12. barbituric acid	--	--	--	--
13. librium	1	.5	1	.5
14. no drug found	1	.5	1	.5

* Reported as a product of an intermediate analysis.

TABLE 3

RELATIONSHIP AMONG THE DRUG NAMES USED

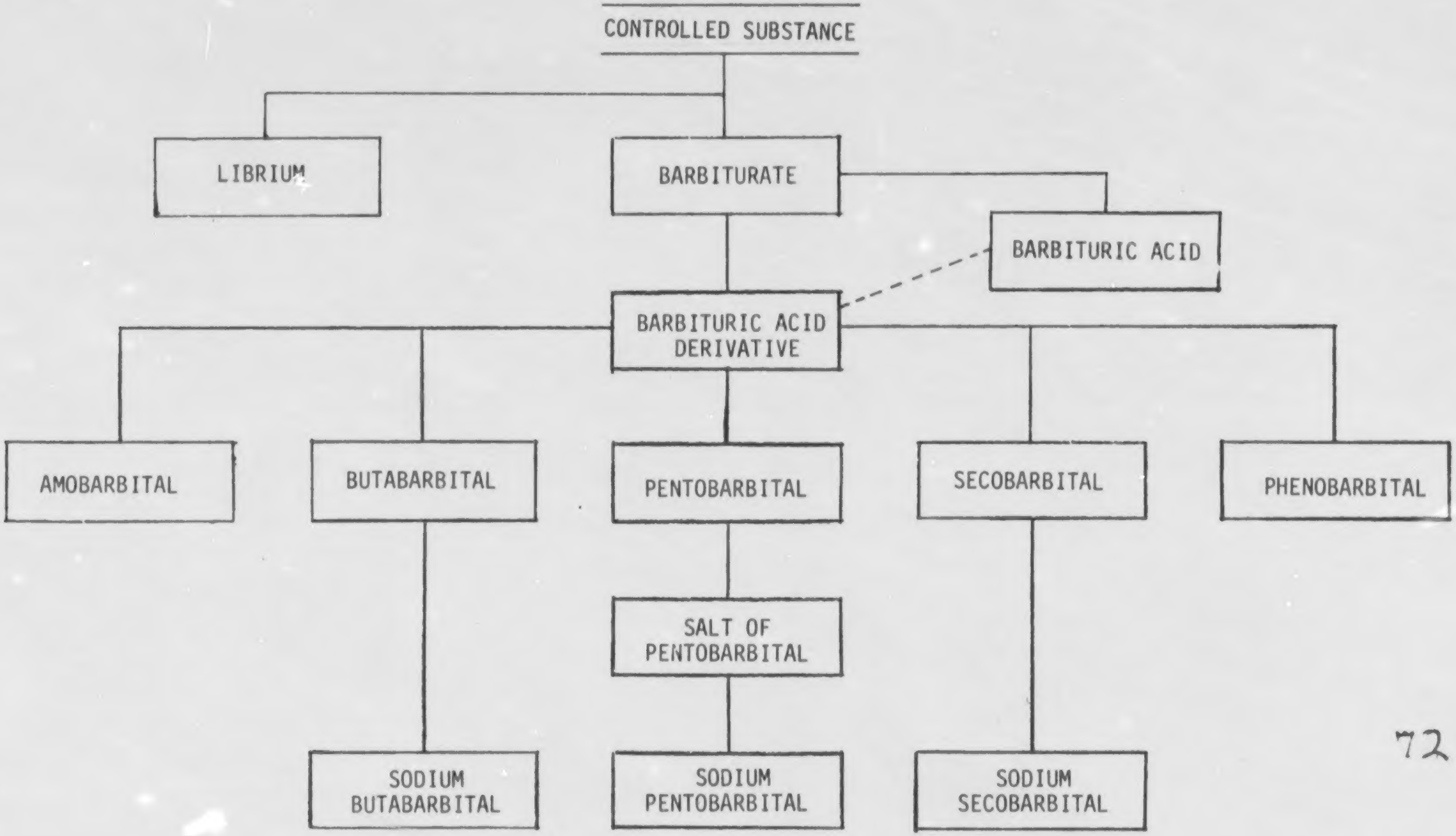


TABLE 4

METHODS USED IN DETERMINING SUBSTANCE

This table gives the number of laboratories which used each type of test. Since most laboratories used more than one test, the total number of tests performed is more than the total number of laboratories.

	Test or method	Number of laboratories	% of total labs (total=200)*
A	Color Tests	166	83%
B	$KMnO_4$	2	1%
C	Crystalline Tests	97	49%
D	Commercial Kit	1	.5%
E	Flame Test	2	1%
F	Melting Point	13	7%
G	TLC	50	25%
H	UV	121	61%
I	IR	99	50%
J	NMR	3	2%
K	GC	79	40%
L	GC/MS	7	4%
M	MS	3	2%

* Late responses (5) not included in tabulation.

TABLE 5

INSTRUMENTS AND METHODS (IN APPROXIMATE ORDER FROM PRESUMPTIVE TO DEFINITIVE)

A SCREENING COLOR TESTS [PRESUMPTIVE]

1. Koppanyi Reagent
2. Dille-Koppanyi Spot Color Test [cobalt acetate-isopropyl amine, test for barbiturates]
3. Zwicker's [copper sulfate-pyridine, test for barbiturates]
4. Mayer's [screening test], positive for alkaloids
5. Marquis' [screening test, positive for alkaloids and amphetamine]
6. Mecke [screening test, positive for alkaloids and amphetamine]
7. fluorescence in tartaric acid
8. PDMB [p-dimethylaminobenzaldehyde, screening test, positive for LSD]
9. cobalt(II) thiocyanate [$Co(CNS)_2$, screening test, positive for cocaine type materials]
10. Furfural/HCl
11. Froehde's [screening test]
12. Liebermann's [screening test]
13. Parri [Dille-Koppanyi]
14. VanUrk
15. cobalt nitrate [$Co(NO_3)_2$, screening test]
16. Sanchez

B POTASSIUM PERMANGANATE FOR SECOBARBITAL ($KMnO_4$)

C CRYSTALLINE TESTS

1. Wagenaar's Reagent [copper sulphate-ethylenediamine, positive for barbiturates]
2. Davis Silver Reagent
3. sulphuric acid and water (H_2SO_4-H_2O)
4. potassium hydroxide and phosphoric acid (KOH-H_3PO_4)
5. Wagner's reagent (I_2-KI)
6. potassium iodide and phosphoric acid (KI-H_3PO_4)
7. pptd free acid, microscopic recognition
8. perchloric acid ($HClO_4$)
9. gold chloride

D COMMERCIALLY AVAILABLE ANALYSIS KIT

E FLAME TEST

F MELTING POINT

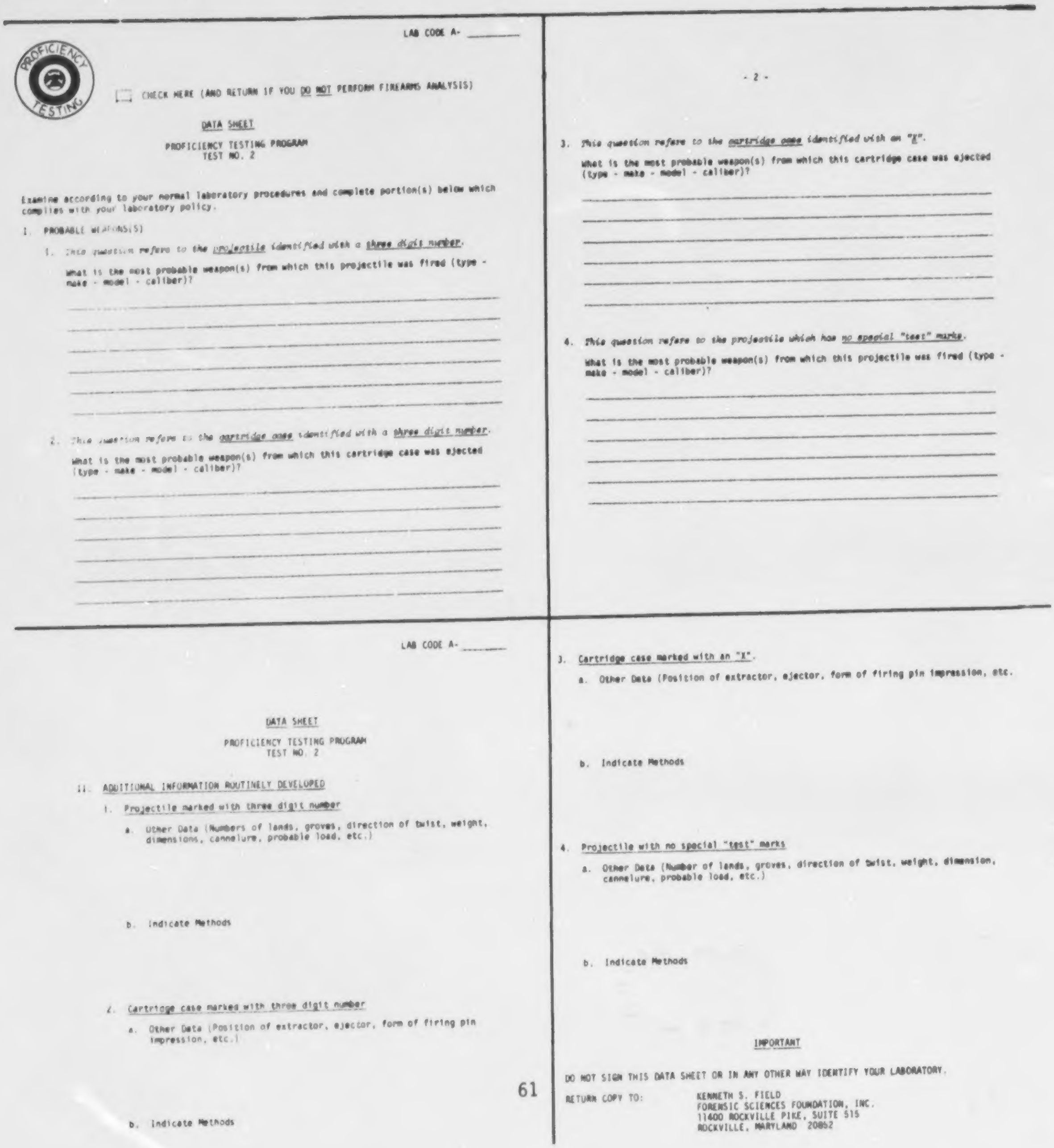
1. melting point
2. mixed melting point

TABLE 5
CONTINUED

G	[THIN LAYER CHROMATOGRAPHY] TLC
H	UV [ULTRAVIOLET SPECTROPHOTOMETRY] FOR IDENTIFICATION
I	IR [INFRARED SPECTROPHOTOMETRY] FOR IDENTIFICATION
J	NMR [NUCLEAR MAGNETIC RESONANCE]
K	GAS CHROMATOGRAPHY (including: 1) gas chromatography-GC, 2) gas-liquid chromatography-GLC, 3) vapor phase chromatography-VPC)
L	GAS CHROMATOGRAPHY/MASS SPECTROMETRY [GC/MS]
M	MASS SPECTROMETRY [MS]

FIGURE 8

FIREARMS



LAB CODE A- ________

PROFICIENCY TESTING

☐ CHECK HERE (AND RETURN IF YOU DO NOT PERFORM FIREARMS ANALYSIS)

DATA SHEET

PROFICIENCY TESTING PROGRAM
TEST NO. 2

Examine according to your normal laboratory procedures and complete portion(s) below which complies with your laboratory policy.

I. PROBABLE WEAPONS(S)

1. *This question refers to the projectile identified with a three digit number.*

   What is the most probable weapon(s) from which this projectile was fired (type - make - model - caliber)?

2. *This question refers to the cartridge case identified with a three digit number.*

   What is the most probable weapon(s) from which this cartridge case was ejected (type - make - model - caliber)?

- 2 -

3. *This question refers to the cartridge case identified with an "X".*

   What is the most probable weapon(s) from which this cartridge case was ejected (type - make - model - caliber)?

4. *This question refers to the projectile which has no special "test" marks.*

   What is the most probable weapon(s) from which this projectile was fired (type - make - model - caliber)?

LAB CODE A- ________

DATA SHEET

PROFICIENCY TESTING PROGRAM
TEST NO. 2

II. ADDITIONAL INFORMATION ROUTINELY DEVELOPED

1. Projectile marked with three digit number
   - a. Other Data (Numbers of lands, groves, direction of twist, weight, dimensions, cannelure, probable load, etc.)
   - b. Indicate Methods
2. Cartridge case marked with three digit number
   - a. Other Data (Position of extractor, ejector, form of firing pin impression, etc.)
   - b. Indicate Methods
3. Cartridge case marked with an "X".
   - a. Other Data (Position of extractor, ejector, form of firing pin impression, etc.
   - b. Indicate Methods
4. Projectile with no special "test" marks
   - a. Other Data (Number of lands, groves, direction of twist, weight, dimension, cannelure, probable load, etc.)
   - b. Indicate Methods

IMPORTANT

DO NOT SIGN THIS DATA SHEET OR IN ANY OTHER WAY IDENTIFY YOUR LABORATORY.

RETURN COPY TO:
KENNETH S. FIELD
FORENSIC SCIENCES FOUNDATION, INC.
11400 ROCKVILLE PIKE, SUITE 515
ROCKVILLE, MARYLAND 20852

The manufacturer prepared the four firearms items for Test Sample #2 as follows:

> Item #1 ("A" and three digit lead projectile) and Item #2 (three digit marked cartridge case) were prepared by firing 200 rounds of a .38 Special Remington (R-P), 158 grain lead ammunition of one lot in a .38 Smith and Wesson Special, M&P revolver, Ser. No. C222994, frame-crane #33244, blue-steel, having a five inch barrel and being in fair to good condition.
>
> Item #3 ("X" marked cartridge case) and Item #4 (unmarked jacketed projectile) were prepared by firing 200 rounds of .380 auto Winchester (w-w), 95 grain, full metal case ammunition of two lots in a P. Beretta 9 mm Corto (.380 Auto) Model 1934, Brevettato auto loading pistol, Ser. No. #686256 (Bardone V.T. 1938-XVI), being in good condition and with a fair barrel.

Although the cartridges and projectiles were prepared together, the assumption should not have been made in advance that they came from the same weapons.

The purpose of this sample was to assess the capabilities, practices and reporting methods of the various laboratories in handling "no gun" cases and the breadth, distribution and completeness of firearms rifling data and cartridge case class characteristic information.

Table 6

Characteristics Derived From Laboratory Responses and the Number of Labs Reporting Each Characteristic

The total number of laboratories returning data is 121.*

Projectile, Three Digits	
revolver	115
38 caliber	120
special	109
5 lands	118
right twist	118
Cartridge Case, Three Digits	
revolver	106
38 caliber	115
special	105
Projectile, No Marks	
automatic	109
380 caliber	116
6 lands	116
right twist	117
Cartridge Case, "X" Mark	
automatic	107
380 caliber	108

---

* Late responses (3) not included in tabulation.

Table 7

REVOLVERS NAMED FOR PROJECTILE (ITEM 1)

	Number of Laboratories Reporting This Name For Projectile
Smith & Wesson	111
Sturm Ruger	36
I.N.A. (Brazilian)	16
Harrington & Richardson	14
Iver Johnson	11
Hopkins & Allen	7
Meriden Fire Arms Co.	6
Llama (Gabilondo y Cia Victoria-Llama)	5
Eibar (Spanish)	4
Forehand & Wadsworth	3
Ruby	3
Orbea (Spanish)	2
"Alamo Ranger"	2
Alfa	1
Century Arms (Spanish)	1
Destroyer (Spanish)	1
Eastern Arms Co.	1
Gabilondo y Cia	1
Garantazado	1
Guisasula Bros. & Co., G.H. (Spanish)	1
Great Western Derringer	1
Ind. DeArms	1
Merwin-Hubert	1
Miroku (Japanese)	1
Rossi	1
SEN	1
Sociadad Alpha	1
Any .38 SPL Caliber	8

Table 8

REVOLVERS NAMED FOR CARTRIDGE CASE (ITEM 2)

	Number of Laboratories Reporting This Name For Cartridge
Smith & Wesson	36
Colt	14
Sturm Ruger	8
I.N.A. (Brazilian)	6
Rohm	4
Rossi	3
EIG	3
Llama (Gabilondo y Cia Victoria-Llama)	3
Taurus	3
Arminus	2
Charter Arms	2
Hawes	2
Harrington & Richardson	2
Iver Johnson	2
Miroku (Japanese)	2
Andrew Fyrderg & Co.	1
Astra	1
Astra-Unceta y Cia	1
Century Arms (Spanish)	1
Dardick	1
Destroyer (Spanish)	1
Fabric DeArms Garatazades Eibar (Spanish)	1
Forehand & Wadsworth	1
Garantazado	1
Garate Bros. & Co., G.H. (Spanish)	1
J.P. Gawer	1
G. H. Revolver (Spain)	1
Great Western	1
Herters	1
Hopkins & Allen	1
Hy Hunter	1
Interarms	1
Meriden Fire Arms Co.	1
Merril	1
Orbea (Spanish)	1
Remington & Sons	1
Ruby	1
Sociadad Alpha	1
Spesco	1
Star	1
TAC (Spanish)	1
Thompson-Center Arms	1
Titan	1
A. Uberti and Co.	1
Dan Wesson	1
Any .38 SPL	80

Table 9

AUTOMATICS NAMED FOR PROJECTILE (ITEM 3)

	Number of Laboratories Reporting This Name For Projectile
Beretta	90
Walther	63
Astra	52
Ceska Zbrojovka (Czech)	30
Savage	29
HI Standard	20
Bernardelli	19
Star	16
Llama	14
Browning	9
Ortgies	8
Bayard	5
MAB	5
Frommer	4
Kirikkale	4
Mauser	4
Webley & Scott	4
Bergman	3
Galesi (Italian)	3
Tauler	3
Bufalo (Spanish)	2
Campo-Giro	2
Colt	2
Luger	2
Radom	2
Republic Espanola	2
Webley	2
Basque	1
Baynard	1
Corto	1
Echasa (Spanish)	1
Fast Eibar	1
Glisenti	1
Handy	1
Harrington & Richardson	1
Heckler & Koch	1
Hijos do Calixto	1
Manurhin	1
Nickl	1
Remington-Arms	1
Rep. Espanda	1
Smith & Wesson	1
Sterling	1
Suomi	1
Yovanovitch	1
Any .380 Auto	14

Table 10

AUTOMATICS NAMED FOR CARTRIDGE CASE (ITEM 4)

	Number of Laboratories Reporting This Name For Cartridge
Beretta	69
Astra	18
Walther	16
Savage	8
Browning	7
Llama	7
Bernardelli	6
Ceska Zbrojovka	6
HI Standard	3
Remington	3
Colt	2
Frommer	2
Kirikkale	2
MAB	2
Mauser	2
Ortgies	2
Star	2
Tauler	2
Bergman	1
Brixia	1
Bufalo (Spanish)	1
Campo-Giro	1
DWA	1
Fimaru	1
Fimaru-Fegyuer	1
Galesi (Italian)	1
Handy	1
Lahti	1
Luger	1
Mugica	1
Radom	1
Sauer	1
SIG	1
Smith & Wesson	1
Sterling	1
Suomi	1
Any .380 Auto	41

Table 11

DIAMETER OF .38 SPECIAL PROJECTILE

Measured Diameters of .38 Special Projectiles, In Inches	Number of Laboratories Reporting This Diameter
0.313	1
.345	1
.346	1
.349	2
.35	3
.350	3
.351	1
.352	6
.353	12
.354	10
.355	8
.356	10
.357	9
.358	3
.359	1
.361	1
.375	1

Average = 0.354

Total Laboratories Reporting = 73

Standard Deviation = 0.006

Table 12

LAND WIDTHS OF .38 SPECIAL PROJECTILE

Measured Land Widths of .38 Special Projectiles, In Inches	Number of Laboratories Reporting This Width
0.091	1
.093	1
.094	1
.095	1
.096	2
.097	3
.098	2
.099	7
.100	10
.101	5
.102	7
.103	8
.104	2
.105	2
.108	1
.109	1
.110	1
.114	1
.115	1

Average = 0.101

Total Laboratories Reporting = 57

Standard Deviation = 0.004

Table 13

GROOVE WIDTHS OF .38 SPECIAL PROJECTILE

Measured Groove Widths of .38 Special Projectiles, In Inches	Number of Laboratories Reporting This Width
0.100	2
.102	2
.104	1
.107	3
.108	1
.109	1
.110	3
.111	2
.112	3
.113	3
.114	4
.115	9
.116	3
.117	3
.120	1
.121	1
.122	1

Average = 0.112

Total Laboratories Reporting = 43

Standard Deviation = 0.005

Table 14

DIAMETER OF .380 AUTOMATIC PROJECTILE

Measured Diameters of .380 Automatic Projectiles, In Inches	Number of Laboratories Reporting This Diameter
0.345	1
.350	2
.351	5
.352	1
.353	2
.354	6
.355	13
.356	9
.357	10
.358	10
.359	6
.360	1
.362	1
.364	1

Average = 0.356

Total Laboratories Reporting = 68

Standard Deviation = 0.003

Table 15

LAND WIDTHS OF .380 AUTOMATIC PROJECTILE

Measured Land Widths of .380 Automatic Projectiles, In Inches	Number of Laboratories Reporting This Width
0.045	4
.046	4
.047	4
.048	6
.049	5
.050	8
.051	9
.052	6
.053	6
.055	2
.056	2
.059	2
.061	2

Average = 0.051

Total Laboratories Reporting = 60

Standard Deviation = 0.004

Table 16

GROOVE WIDTH OF .380 AUTOMATIC PROJECTILE

Measured Groove Widths of .380 Automatic Projectiles, In Inches	Number of Laboratories Reporting This Width
0.123	1
.124	1
.125	2
.126	1
.127	3
.128	4
.129	7
.130	6
.131	1
.132	2
.133	1
.134	1
.135	2
.140	1

Average = 0.129

Total Laboratories Reporting = 33

Standard Deviation = 0.003

LAB CODE A- ____________

PROFICIENCY TESTING

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM BLOOD ANALYSIS

DATE RECEIVED IN LAB____________

DATE PROCESSED IN LAB____________

DATA SHEET
PROFICIENCY TESTING PROGRAM
TEST #3
HUMAN BLOOD ANALYSIS

The sample is a human blood stain, therefore we ask that you supply only the methodology you would use in answering questions 1 and 2. It is not necessary to perform the actual tests. This applies to questions 1 and 2 only.

1. Indicate the methods you would normally use to ascertain that the sample is blood.

   Method(s):

2. Indicate the methods you would normally use to ascertain that the blood is from human species.

   Method(s):

Examine according to your normal laboratory procedures and complete portion(s) which comply with your laboratory policy.

3. a. What is the ABO factor? ____________________

   b. Indicate method(s) used:

4. If your laboratory has the capabilities to perform any other grouping or subgrouping procedures (such as MN, Rh, or isoenzymes, etc.) run any or all of them and report your findings here. (For each grouping or subgrouping identify, please indicate the methods used. Attach additional sheets if necessary.)

   Group:

   Method(s):

   Group:

   Method(s):

FIGURE 9
BLOOD EXAMINATION

The human blood stain sample(Test Sample#3) was characterized by the manufacturer as follows:

ABO factor: group B

Rh: Positive, Cc D Ee

MN: type MN

EAP: type A

AK: type 1

PGM: type 2-1

The objectives for Test Sample #3 were to test the capabilities of the laboratories in the ABO grouping system under controlled conditions which included large sample sizes, clean substrate and a bloodstain in clean, uncontaminated condition.

The sample consisted of four drops of a known (type B) blood from a single donor collected by finger lance on clean sheeting. The sample was air dried.

Problems encountered were obtaining sufficient quantity of sample in this case requiring multiple finger sticks. The method of choice which was employed in subsequent blood tests was venipuncture.

Samples were hand carried to the project staff for packaging and mailing with as little delay as possible to prevent deterioration of the sample.

TABLE 17

METHODS FOR DETERMINING THAT SAMPLE IS BLOOD

This table gives the number of laboratories indicating their normal use of each test method for determining that a sample is blood (Question 1). Note that laboratories were not requested to actually perform this analysis. Since many laboratories indicated more than one method, the total number is greater than the total number of laboratories reporting.

Number of Laboratories	Test Method
1	A absorption elution
	B Color Tests
110	1. benzidine
1	2. benzylidine dimethylaniline
20	3. hematest (commercial)
2	4. Kastle-Mayer reagent
14	5. leucomalachite green
4	6. luminol spray (commercial)
19	7. ortho-tolidine
45	8. phenolphthalein
	C Crystal Tests
1	1. hematoporphyrin
2	2. hemin crystals
2	3. hemochromogen
41	4. Takayama
7	5. Teichmann
2	D electrophoresis
1	E gel diffusion precipitin reaction
8	F macroscopic examination
13	G microscopic examination
3	H precipitin tests
1	I spectrophotometric method
1	J ultraviolet method
1	K Wright-Giemse method

TABLE 18

METHODS FOR DETERMINING THAT SAMPLE IS HUMAN BLOOD

This table gives the number of laboratories indicating their normal use of each test method for determining that a sample is human blood (Question 2). Note that laboratories were not requested to actually perform this analysis. Since many laboratories indicated more than one method, the total number is greater than the total number of laboratories reporting.

Number of Laboratories	Test Method
1	A agglutination test
1	B an experimental technique using sensitized latex particles
34	C electrophoretic tests
1	D microscopic examination
136	E precipitin tests (agar, gel, or liquid phase)

TABLE 19

METHODS FOR DETERMINING ABO FACTOR OF HUMAN BLOOD

This table gives the number of laboratories indicating each test method used for determining the ABO factor of human blood (Question 3). Since many laboratories used more than one method, the total number is greater than the total number of laboratories reporting.

Number of Laboratories		Test Method
142	A	absorption elution
20	B	absorption inhibition
1	C	acacia method for isoagglutinogens
1	D	agglutinin absorption test of Weiner
1	E	extraction
1	F	extraction test tube method for isoagglutinins
1	G	forward grouping
77	H	Lattes crust test (direct method, reverse typing)
4	I	mixed agglutination method

TABLE 20

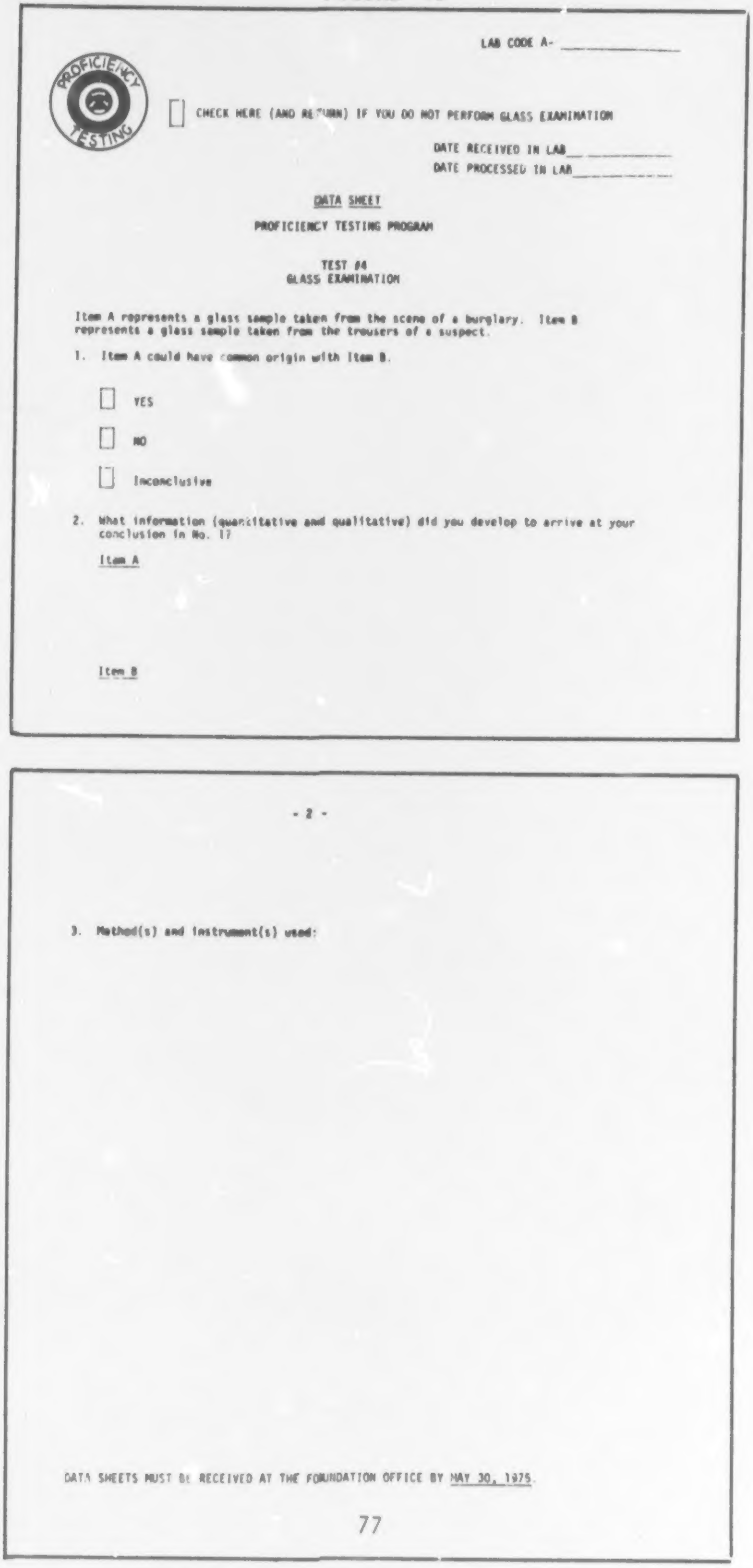
METHODS FOR DETERMINING ADDITIONAL BLOOD SUBGROUPS

This table gives the number of laboratories indicating each method used for the determination of additional groups and subgroups (Question 4). Since some laboratories used more than one method, the total number is greater than the total number of laboratories reporting such tests.

Number of Laboratories		Test Method
3	A	electrophoresis test for AK
15	B	electrophoresis test for EAP
2	C	starch gel electrophoresis test for EsD
4	D	electrophoresis test for Hb
6	E	cellulose acetate or membrane strip electrophoresis test for Hb
2	F	electrophoresis test for Hp
1	G	electrophoresis test for LDH
24	H	absorption elution test for MN
1	I	absorption inhibition test for MN
20	J	gel electrophoresis test for PGM
1	K	cellulose acetate or membrane strip electrophoresis test for PGM
23	L	absorption elution test for Rh
1	M	absorption inhibition test for Rh
1	N	Leister & Kirk test for Rheumatoid Arthritis Factor

92

FIGURE 10



LAB CODE A- ____________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM GLASS EXAMINATION

DATE RECEIVED IN LAB____________
DATE PROCESSED IN LAB____________

DATA SHEET

PROFICIENCY TESTING PROGRAM

TEST #4
GLASS EXAMINATION

Item A represents a glass sample taken from the scene of a burglary. Item B represents a glass sample taken from the trousers of a suspect.

1. Item A could have common origin with Item B.

☐ YES

☐ NO

☐ Inconclusive

2. What information (quantitative and qualitative) did you develop to arrive at your conclusion in No. 1?

Item A

Item B

- 2 -

3. Method(s) and instrument(s) used:

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The glass samples (Test Sample #4) were characterized by the manufacturer as follows:

COLOR

Both are clear glass and cannot be distinguished on this basis.

FLUORESCENCE

Type B glass has some tin dissolved into one of its surfaces and exposure to ultraviolet light will cause the glass to fluoresce. Type A glass does not contain tin.

COMPOSITION

The composition of the glasses are as follows:

	Type A	Type B
SiO_2	73.37%	73.20%
Na_2O	13.16	13.64
K_2O	0.24	0.03
CaO	8.26	8.87
MgO	3.61	3.95
Al_2O_3	1.22	0.15
SO_3	0.18	0.25
Fe_2O_3	0.112	0.082
Total	100.15	100.16

DENSITY

Typical nominal values for densities are as follows:

Type A	Type B
2.4860 g/cc	2.4945 g/cc
2.4862	2.4947
2.4821	2.4949
2.4876	2.4949
2.4859	2.4944
2.4852	2.4952

REFRACTIVE INDEX

Typical refractive indices are as follows:

N_D (Sodium Line) Refractive Index Type A	N_D (Sodium Line) Refractive Index Type B
1.5167	1.5186

1.5167	1.5185
1.5158	1.5186
1.5167	1.5185
1.5168	1.5186
1.5166	1.5186

The glass was prepared for the project by the Pittsburgh Plate Glass Company. Sheets were broken into pieces approximately 1" x 1" in sufficient quantities for all participating laboratories and forwarded to the project staff for packaging and mailing.

Table 21

Refractive Index and Density Differences: B minus A

	Differences in Refractive Index	Differences in Density - g/cm^3
Laboratory 1 - Ave. of 3 pieces	0.00261	0.01575
Laboratory 2 -	0.002	0.006
Laboratory 3 - RI measured at 3 λ's	0.0029/0.0028/0.0031	0.01430
Sampler Supplier - Ave. of 6 pieces	0.00205	0.00930
Average of Results from 35 Labs	0.00254	---------
Standard Deviation of these 35 results	0.0007	

96

Table 22

Relative Frequencies of the Reported Methods

Refractive Index	90
Density	77
Thickness	50
U.V. Light	42
Elemental Analysis	18
Dispersion Curves	14
Color	9
Dispersion Staining	8
X-Ray Fluorescence	8
Physical Edge Match	4

FIGURE 11
AUTO PAINT EXAMINATION

LAB CODE A-________________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM AUTO PAINT EXAMINATION

DATE RECEIVED IN LAB________________

DATE PROCESSED IN LAB________________

DATA SHEET

PROFICIENCY TESTING PROGRAM

TEST #5
AUTO PAINT EXAMINATION

Item A represents a paint specimen recovered from the clothing of a dead victim found at roadside--an apparent hit-and-run victim. (Disregard metal base plate.)

Items B and C were taken from two separate suspect vehicles. (Disregard metal base plate.)

1. Item A could have common origin with:

   ☐ B

   ☐ C

   ☐ Both

   ☐ Neither

2. What information (quantitative and qualitative) did you develop to arrive at your conclusion in No. 1?

   Item A

   Item B

   Item C

3. Method(s) and instrument(s) used:

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The auto paint samples (Test Sample #5) can be characterized according to the sample manufacturer specifications as follows:

> Samples A, B, and C are the same color - American Motors Sienna Orange (G6). All three samples have a triple layer sequence of orange topcoat, medium gray primer and dark gray primer. Samples A and C are the same and were prepared using topcoat and primer from U.S. paint suppliers. Sample B was prepared using a topcoat and primer supplied by a Canadian supplier and is representative of material used at the American Motors Canadian plant. There is a difference (formulation) in composition between the topcoats of Sample B versus A and C, therefore Item A could have common origin only with C.

In future tests of this type, the Project Advisory Committee feels that it would be preferable to take actual scrapings of paint off a vehicle. While it is recognized that this would pose rather large problems in the area of quality control, the approximation of actual case type situations would be valuable. The metal base plate the samples were actually prepared on was unrealistic and misleading.

Table 23

Relative Frequencies of the Reported Methods

INSTRUMENTS OR METHODS USED	NUMBER OF LABORATORIES
1. Microscope	98
2. Solubility tests	88
3. Infrared analysis	51
4. Emission spectroscopy	41
5. Pyrolysis gas chromatography	40
6. X-ray fluorescence	22
7. Reference collection of automotive paint colors	14
8. Ultraviolet spectrophotometry	14
9. Visual	11
10. X-ray diffraction	10
11. Thin layer chromatography	3
12. Density test	3
13. Fluorescent studies	3
14. Filters, Wratten and dichroic	1
15. Pyrolysis IR	1
16. Photographic color densitometer	1
17. Microcrystal	1
18. Spot plates	1
19. Quantitative elemental analysis	1
20. Reflectance spectrum	1
21. None listed	1

Since most laboratories indicated more than one method, the total number is greater than the total number of laboratories reporting.

Table 24

Ten Most Frequently Reported Methods

Method	Total Number of Labs Reporting Use Of This Method	Number of Labs Reporting They Could Distignguish Item B from A and C By This Method	Number of Labs Reporting They Could Not Distinguish Item B from A and C By This Method	Number of Labs Reporting Use Of This Method Without Reporting Their Findings for The Method
1. Microscope	98	19	54	25
2. Solubility Tests	88	41	25	22
3. Infrared Analysis	51	2	37	12
4. Emission Spectroscopy	41	18	14	9
5. Pyrolysis Gas Chromatography	40	27	1	12
6. X-Ray Fluorescence	22	21	1	0
7. Reference Collection of Automotive Paint Colors	14	1	11	2
8. Ultraviolet Spectrophotometry	14	1	6	7
9. Visual	11	3	6	2
10. X-Ray Diffraction	10	1	7	2

Table 25

Most Frequently Reported Solvents

	Total Number of Labs Reporting Use Of This Solvent	Number of Labs Reporting They Could Distinguish Item B from A and C Using This Solvent	Number of Labs Reporting They Could Not Distinguish Item B from A and C Using This Solvent	Number of Labs Reporting Use Of This Solvent Without Reporting Their Findings For This Solvent
1. Acetone	48	1	33	14
2. Sulfuric acid	47	34	6	7
3. Chloroform	34	1	25	8
4. Hydrochloric acid	23	3	12	8
5. Ethyl acetate	17	0	14	3
6. Sodium hydroxide	14	0	8	6
7. Nitric acid	15	7	3	5
8. Diphenylamine	14	5	3	6
9. Benzene	9	0	8	2
10. Methylene chloride	8	0	6	2
11. Methanol	5	0	4	1
12. Dimethylformamine	6	1	4	1

FIGURE 12

DRUG EXAMINATION

LAB CODE A-__________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM DRUG ANALYSIS

DATE RECEIVED IN LAB __________

DATE PROCESSED IN LAB __________

DATA SHEET

PROFICIENCY TESTING PROGRAM

TEST #6

DRUG ANALYSIS

1. The enclosed substance was a street buy. The agent needs all the qualitative and quantitative information you can give him.

2. Indicate method(s) used:

The manufacturer has characterized test sample # 6 as a blend with a nominal value of 3% heroin, 3% cocaine, 3% procaine and 91% lactose.
Results submitted by two referee laboratories have an average value of 2.7% heroin, 2.6% cocaine and 3.1% procaine.

The intent of the second drug sample was to provide the laboratories with a combination of "hard" drugs that are commonly encountered, specifically heroin and cocaine. The diluents chosen were common types, procaine and lactose. The substances were obtained from DEA and mixed in a small mechanical mixer to ensure homogeneity.

The mixed sample was then forwarded to the project staff for packaging and distribution.

Table 26

Frequency of Substances Reported

	number of laboratories reporting this substance	% of total labs (total = 179)*
Heroin	177	98.9
Procaine	130	72.6
Cocaine	126	70.4
Lactose	59	33.0
Reducing sugar	31	17.3
Monoacetylmorphine	12	6.7
Starch, carbohydrate	4	2.2
Acetylcodeine	3	1.7
Morphine	2	1.1
Chlorine	2	1.1
Quinine	1	.6
Methapyrilene	1	.6

Since most laboratories indicated more than one substance, the total number is greater than the total number of laboratories reporting.

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* Late responses (2) not tabulated.

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Table 27

Frequency of Methods Used in Determining Substance

	number of laboratories reporting use of this method	% of total labs (total = 179)*
1. Color Tests	154	86.0
2. Thin Layer Chromatography	120	67.0
3. Gas Chromatography	118	65.9
4. UV Spectrometry	118	65.9
5. Microcrystalline Tests	96	53.6
6. IR Spectrometry	66	36.9
7. Gas Chromatography/Mass Spectrometry	29	16.2
8. Extraction	26	14.5
9. Column Chromatography	17	9.5
10. Melting Point Test	6	3.4
11. Precipitation	4	2.2
12. Nakamura's Procedure	3	1.7
13. X-ray Diffraction	2	1.1
14. Odor Test	2	1.1
15. Fluorescence Exam	2	1.1
16. General screen for acid and neutral drug	2	1.1
17. Ashing	1	.6
18. Tollens Test	1	.6
19. Arthur and Smith test for Cl^-	1	.6
20. X-ray fluorescence	1	.6
21. Paper Chromatography	1	.6
22. Alpha-napthol test for carbohydrates	1	.6
23. No methods indicated	3	1.7

Since most laboratories indicated more than one method, the total number is greater than the total number of laboratories reporting.

* Late responses (2) not tabulated.

Table 28

Frequency of Color Tests Used in Determining Substance

1. Color Tests	number of laboratories reporting use of this test	% of specifying labs (total = 102)
a. Marquis	102	100.0
b. Cobaltus Thiocyanate	71	69.6
c. Mecke	61	59.8
d. Froehde	57	55.9
e. Dille-Koppanyi	35	34.3
f. Sanchez	33	32.4
g. Nitric Acid	27	26.5
h. Van Urk	19	18.6
i. Ferric Chloride	11	10.8
j. Mayers	8	7.8
k. Fehlings reagent	7	6.9
l. Mandelins test	7	6.9
m. Benedicts test	5	4.9
n. Ruybals test	5	4.9
o. Scotts test	4	3.9
p. Mollisch test	3	2.9
q. FPN	3	2.9
r. Liebermans test	3	2.9
s. Salicylate reagent	3	2.9
t. Zwikker	2	2.0
u. Tannic acid	2	2.0
v. Lafons test	2	2.0
w. Bleach (Dopper's reagent)	2	2.0
x. Silver Nitrate	2	2.0
y. Iodoplatinate	2	2.0
z. Trinders test	1	1.0
aa. Olivers test	1	1.0
bb. Tantaure acid	1	1.0
cc. Stannous Chloride	1	1.0
dd. Oxyacid test	1	1.0
ee. Potassium Permanganate	1	1.0
ff. Picric acid	1	1.0
gg. Roberts test	1	1.0
hh. Parri test	1	1.0
ii. Potassium Hydroxide	1	1.0
jj. Glycerol Cobalt	1	1.0
kk. Chen's test	1	1.0
ll. Starch test	1	1.0
mm. Barium Chloride	1	1.0

154 laboratories reported using color tests.
52 (or 33.8%) did not specify which color test(s).
102 laboratories did specify color test(s) used.

Since most laboratories indicated more than one color test, the total number is greater than the total number of laboratories reporting.

Table 29

Frequency of Microcrystalline Tests Used in Determining Substance

5. Microcrystalline Tests	number of laboratories reporting use of this test	% of specifying labs (total = 64)
a. Mercuric Iodide	43	67.2
b. Mercuric Chloride	13	20.3
c. Gold Chloride	13	20.3
d. Platinum Chloride	12	18.8
e. Wagners test	10	15.6
f. Gold Bromide	6	9.4
g. Sodium Acetate	4	6.3
h. Acetic Acid	3	4.7
i. Lead Iodide	1	1.6
j. Potassium Acetate	1	1.6
k. Platinum Bromide	1	1.6
l. Sodium Chloride	1	1.6

96 laboratories reported using microcrystalline test(s).
32 (or 33.3%) did not specify which microcrystalline test(s).
64 did specify which microcrystalline test(s) used.

Since many laboratories reported more than one microcrystalline test used, the total number is greater than the total number of laboratories reporting.

Table 30

Frequency of Methods Used in Determining Substance for Laboratories that Identified Heroin and Cocaine

		number of laboratories reporting use of this method	% of total labs (total = 125)
1.	Color Tests	104	83.2
2.	Thin Layer Chromatography	93	74.4
3.	Gas Chromatography	101	80.8
4.	UV Spectrometry	82	65.6
5.	Microcrystalline Tests	55	44.0
6.	IR Spectrometry	46	36.8
7.	Gas Chromatography/Mass Spectrometry	26	20.8
8.	Extraction	22	17.6
9.	Column Chromatography	13	10.4

Table 31

Frequency of Methods Used in Determining Substance for Laboratories That Identified Heroin Only

		number of laboratories reporting use of this method	% of total labs (total = 52)
1.	Color Tests	48	92.3
2.	Thin Layer Chromatography	27	51.9
3.	Gas Chromatography	18	34.6
4.	UV Spectrometry	35	67.3
5.	Microcrystalline Tests	33	63.5
6.	IR Spectrometry	18	34.6
7.	Gas Chromatography/Mass Spectrometry	1	1.9
8.	Extraction	3	5.8
9.	Column Chromatography	4	7.7

FIGURE 13
FIREARMS EXAMINATION

LAB CODE A-__________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM FIREARMS EXAMINATIONS

DATE RECEIVED IN LAB __________

DATE PROCESSED IN LAB __________

DATA SHEET

PROFICIENCY TESTING PROGRAM
TEST NO. 7

FIREARMS EXAMINATION

Examine according to your normal laboratory procedures and complete portion(s) below which complies with your laboratory policy.

SCENARIO: Two homicides have occurred, approximately ten days apart. At the scene of homicide #1 there were recovered one projectile and one cartridge case. At the scene of homicide #2 there were recovered two projectiles and one cartridge case.

(All bullets are marked with a letter on the base; cartridge cases, with a number on the side near the open end, read with the open end to your right.)

1. BULLET AND CARTRIDGE CASE COMPARISONS

a. Which, if any, of the three projectiles were fired from the same gun?

☐ None

☐ Projectiles fired from same gun
(List letters)

____

____

____

☐ Inconclusive
Explanation of inconclusive answer:

b. Were the two cartridge cases fired in the same gun?

☐ Yes

☐ No

☐ Inconclusive

2. ADDITIONAL COMMENTS

The firearms samples (test sample #7) can be characterized according to the sample manufacturer as follows:

"Crime Scene 1"

The copper-jacketed bullet (marked on the base with any one of the following letters assigned on the basis of random selection: A, B, C, D, E, F, G, H, J, K, L, O, P, Q, R, S, T, U, V, Y) was fired from a Colt .32 Auto pistol, Serial # 214325. A total of 352 rounds was fired in groups of 16.

The cartridge case (marked on the side with any one of the following numbers assigned on the basis of random selection: 5, 7, 8) was also fired in the Colt .32 Auto pistol, Serial # 214325, mentioned above.

"Crime Scene 2"

The copper-jacketed bullet (marked on the base with any one of the following letters assigned on the basis of random selection: A, B, C, D, E, F, G, H, J, K, L, O, P, Q, R, S, T, U, V, Y) was fired from the same gun and within the same group as the bullet from "Crime Scene 1"; the Colt .32 Auto pistol, Serial #214325.

The other copper-jacketed bullet (marked on the base with any one of the following letters assigned on the basis of random selection: I, M, N, X, Z) was fired from a second Colt .32 Auto pistol, Serial #521524.

The cartridge case (marked on the side with any one of the following numbers assigned on the basis of random selection: 2, 3, 4) was also fired in the same Colt .32 Auto pistol, Serial #521524.

This test was designed to measure the proficiency of laboratories in the comparison of individual characteristics of fired bullets and cartridge cases with highly individual markings.

Bullets and cartridge cases were assembled into test samples that were made up from within the same firing batch. Sixteen to twenty-four bullets fired consecutively was a batch. In order to minimize the possible changes that might have occurred in the barrels over a period of time, no bullets from the first batch of firings were packaged with any bullets from the last batch.

FIGURE 14

BLOOD EXAMINATION

LAB CODE A-____________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM BLOOD ANALYSIS

DATE RECEIVED IN LAB____________

DATE PROCESSED IN LAB____________

DATA SHEET
PROFICIENCY TESTING PROGRAM
TEST #8
BLOOD ANALYSIS

Please examine samples according to your normal laboratory procedures and complete portion(s) which comply with your laboratory policy. The checklists are intended as a convenience in filling out the report; they are not intended to suggest any specific test or battery of tests. Please add any additional information you consider pertinent to your response.

1. Have the stains been confirmed as blood?

	Item A	Item B
Yes	☐	☐
No	☐	☐
Inconclusive	☐	☐

Methods Used:

☐ Color test (Specify)____________
☐ Crystal test (Specify)____________
☐ Macroscopic
☐ Microscopic
☐ Precipitin
☐ Other (Specify)____________

Comments: ____________

2. Have the stains been confirmed as human blood?

	Item A	Item B
Yes	☐	☐
No	☐	☐
Inconclusive	☐	☐

Methods Used:

☐ Electrophoresis
☐ Precipitin
☐ Other (Specify)____________

Comments: ____________

3. Could Item A and Item B have originated from the same source?

☐ Yes ☐ No ☐ Inconclusive

4. What information did you develop to arrive at your conclusion in Question 3? (Attach additional sheets if necessary.) The table is provided for your convenience. It is not intended to suggest any particular test or battery of tests.

Grouping	Item A Type	Item B Type	Methods Used:
ABO			
AK (adenylate kinase)			
Amylase			
EAP (erythrocyte acid phosphatase)			
EsD (esterase D)			
Hb (hemoglobin)			
Hp (haptoglobin)			
LDH (lactic dehydrogenase)			
MN			
PGM (phosphoglucomutase)			
Rh			
Rheumatoid Arthritis factor			
S			
Other (Specify)			

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The blood samples (Test Sample #8) can be characterized according to the sample manufacturer as follows:

	ITEM A (Yellow Cloth)	ITEM B (Blue-White Cloth)
A	- -(Type 0)	- -(Type 0)
B		
D	+	+
C	+	-
E	-	+
c	+	+
e	+	+
M	-	+
N	+	-
S	+	+
s	+	+
Kell	-	-
Duffy	-	-
Kidd	-	-
ADA	1-1	1-1
AK	1-1	1-1
G-^{6}PD	A-A	A-A
Gm (a)	+	+
Gm (x)	-	+
Gm (f_1)	+	+
Gm (b^1)	+	+
Inv 1	-	+
EAP	AB	AA
PGM	2-1	2-1
H_p	2-1	1-1
EsD	1-1	1-1
Gc	2-1	2-1
Amylase$_2$	B	A

The blood was drawn by venipuncture with a sterile syringe and then immediately dropped from the syringe needle onto cloth spread over a polyethylene sheet. After drying for 24 hours at room temperature, the cloth was cut into individual squares and mailed the same day to the Forensic Sciences Foundation. Plastic gloves were worn when the cloth was cut up to avoid contamination. As the cloth was cut up, it was visually checked to ensure that the stain was dry.

The following problems arose during the preparation of the sample. The cloth used was new cotton and was washed twice without detergent before the blood was applied to it. It was not washed with detergent because detergent is known to inhibit agglutination of red blood cells. In retrospect, this was a mistake. The cloth had apparently been subjected to some type of fabric treatment which rendered the surface somewhat hydrophobic, causing the drops of blood to ball up on the surface. The stains did not, therefore, spread out as much as anticipated. If this experiment were attempted in the future, it would be more appropriate to wash the fabric several times with detergent before rinsing several times with boiling water.

Since this sample was prepared and distributed during the summer months, the possibility of sample deterioration (due to heat) which is out of the control of the manufacturer must be considered. As stated in the Methods chapter, the sample was prepared under controllled conditions, but no control could be exercised over the samples after they were out of the Foundation Office. Future blood samples would probably fare better if prepared in other than summer months.

Table 32

Frequencies of Reported Color Tests for Question 1

Question 1: Have the stains been confirmed as blood?

	Instruments or Methods Used	Number of Laboratories	%of reporting labs (total = 115)
a.	Benzidine	83	72.2
b.	Phenolphthalin (Kastle-Meyer reagent)	33	28.7
c.	Ortho-tolidine	15	13.0
d.	Hematest (commercial)	14	12.2
e.	Leucomalachite green	5	4.3
f.	Spectrophotometer	1	.9
g.	Luminol spray (commercial)	1	.9
h.	Benzylidine Dimethylaniline	1	.9
i.	Miscellaneous	1	.9

Table 33

Relative Frequencies of Reported Crystal Tests for Question 1

	Instruments or Methods Used	Number of Laboratories	% of reporting labs (total = 43)
a.	Takayama	41	95.3
b.	Teichmann	6	14.0

Since many laboratories indicated use of more than one method, the total number is greater than the total number of laboratories reporting.

Table 34

Frequencies of the Reported Methods for Question 1

Question 1: Have the stains been confirmed as blood?

	Instruments or Methods Used	Number of Laboratories	% of total labs (total=128)*
1.	Color tests	115	89.8
2.	Crystal tests	43	33.6
3.	Macroscopic	23	18.0
4.	Precipitin	19	14.8
5.	Microscopic	17	13.3
6.	Electrophoresis	2	1.6
7.	Gel diffusion	2	1.6
8.	Suds when wet	1	.8
9.	Hematoporphyrin Fluorescence	1	.8
10.	Spectrophotometric Method	1	.8

Since most laboratories indicated use of more than one method, the total number is greater than the total number of laboratories reporting.

* Late responses (4) not tabulated.

Table 35

Frequencies of the Reported Methods for Question 2

Question 2: Have the stains been confirmed as human blood?

Instruments or Methods Used	Number of Laboratories	% of total labs (total = 128) *
1. Precipitin	115	89.8
2. Electrophoretic tests	26	20.3
3. Absorption elution	19	14.8
4. Immunoelectrophoresis	2	1.6

Since many laboratories reported use of more than one method, the total number is greater than the total number of laboratories reporting.

Table 36

Frequencies of Responses to Question 3

Question 3: Could Item A and Item B have originated from the same source?	Number of Laboratories	% of total labs (total = 128)*
Yes	49	38.3
No	49	38.3
Inconclusive	26	20.3
No Response	4	3.1

* Late responses (4) not tabulated.

Table 37

Number of Grouping Methods Used for Each Response to Question 3

Response to Question 3	Number of Methods Used 1	2	3	4	5	6	7	8
No	6	9	14	10	4	3	1	1
Yes	35	7	2	4	0	1	0	0
INCONCLUSIVE	18	3	1	2	0	0	0	0

Table 38

Frequencies of Use of Grouping Methods for Question 3

Grouping Method Used	Response to Question 3 NO	YES	INCONCLUSIVE
ABO	46	49	24
EAP	28	3	2
PGM	23	6	2
MN	24	5	1
Rh	13	6	1
Hb	7	3	3
EsD	5	2	1
AK	6	1	0

Table 39

Frequencies of Grouping Tests Reported for Question 4

Grouping	Number of Laboratories	% of total labs (total = 128)*
ABO	123	96.1
EAP	33	25.8
PGM	33	25.8
MN	30	23.4
Rh	20	15.6
Hb	15	11.7
EsD	8	6.3
AK	7	5.5
Hp	2	1.6
LDH	1	.8
Rheumatoid Arthritis Factor	1	.8
S	1	.8
6-GPD	1	.8
PCE_2	1	.8
Miscellaneous	3	2.3

Since most laboratories indicated use of more than one grouping, the total number is greater than the total number of laboratories reporting.

---

* Late responses (4) not tabulated.

Table 40

Results for the Most Frequently Reported Grouping Tests

Grouping	Response	Item A	Item B
ABO	Type O	113	109
	Inconclusive	4	8
	No Response	4	4
	B,O	1	1
	✓	1	1
EAP	A (or AA)	1	27
	B	3	1
	AB (or BA)	22	0
	Inconclusive	4	3
	Different	2	1
	No Response	1	1
PGM	1 (or 1-1)	1	2
	2 (or 2-2)	1	0
	2-1 (or 1-2)	27	26
	Probably 2-1	1	2
	Diffuse bands	1	1
	Inconclusive	2	2
MN	M (or M+)	0	22
	M- (or not M)	2	0
	MM (or MN-,M+N-)	1	3
	MN	2	3
	N (or N+)	21	1
	NN	2	0
	No agglutination	1	0
	Inconclusive	1	1
Hb	A (or AA,A/A, Al, Normal Adult)	13	13
	S	1	1
	Inconclusive	1	1
EsD	1-1	2	3
	1-2	1	1
	Same	1	1
	Not detected	1	1
	Inconclusive	3	2
AK	1 (or 1-1)	6	6
	2 (or 2-1)	1	1

PROFICIENCY TESTING

FIGURE 15
GLASS EXAMINATION

LAB CODE A - ____________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM GLASS EXAMINATION

DATE RECEIVED IN LAB __________
DATE PROCESSED IN LAB __________

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #9
GLASS EXAMINATION

Item A and B represent glass samples removed from the clothing of two hit and run victims found in different locations. Item C represents glass removed from a suspect vehicle.

1. Could Item A and B have common origin with Item C?

	Item A	Item B
Yes	☐	☐
No	☐	☐
Inconclusive	☐	☐

2. What information (qualitative and quantitative) did you develop to arrive at your conclusions in Question 1? (Please check all appropriate boxes and provide values where applicable.)

	Item A	Item B	Item C
a. Color			
b. Density			
c. Dispersion Curves			
d. Elemental Analysis			
e. Physical Match			
f. Refractive Index			
g. Thickness			
h. U.V. Light			
i. X-ray Fluorescence			
j. Other (Specify)			

3. Please specify the methods and/or instructions which were used for those methods checked in Question 2. (Example: Refractive Index using Cargille liquids, hot stage; Density gradient tubes with mixture of bromobenzene and bromoform, etc. Attach additional sheets if necessary.)

Method:

Method:

Method:

Method:

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OFFICE BY OCTOBER 6, 1975

The glass samples (test sample #9) were all prepared from a single headlight lens (Corning) with a refractive index of 1.47777. When pieces from different locations on the lens were measured, the refractive index differed by no more than 4 in the 5th decimal place. Therefore, samples A, B, and C are the same.

The unlikelihood of breaking a single headlight lens into a sufficient number of pieces for distribution to all participants caused the manufacturer to saw the lens. This created some problems as far as realism was concerned, however,it did ensure that all the laboratories received equal quantities to analyze.

Samples were mixed following cutting to randomize the distribution and minimize the possibility of adjacent pieces being sent to any one laboratory.

Table 41

Frequency of the Reported Methods Used to Answer Question 2

Question 2: What information did you develop to arrive at your conclusions in Question 1?

Method	Number of Laboratories Reporting Use of This Method	% of Total Lab. (Total = 112)
Color	95	84.8
U.V. Light	95	84.8
Density	92	82.1
Refractive Index	91	81.3
Thickness	60	53.6
Physical Match	53	47.3
Elemental Analysis	44	39.3
Dispersion Curves	37	33.0
X-Ray Fluorescence	16	14.3
Microscopic Examination	4	3.6
Differential I.R.	2	1.8
Emission Spectroscopy	2	1.8
Visual Inspection	2	1.8
Polarized Light	2	1.8
Dispersion Staining	1	0.9
SEM/EDX	1	0.9
Opacity	1	0.9
Isotropic & Conchoidal Fracture	1	0.9
Scratch	1	0.9
DTA	1	0.9
Trace	1	0.9
Hardness	1	0.9

Table 42

Summary of Responses for Question 2

Question 2: What information did you develop to arrive at your conclusions in Question 1?

Method	Response	Number of Labs Reporting this Response
Color	Items A, B, C, clear and/or colorless	33
	Items A, B, C, same	18
	Similar	2
	Opaque	1
	Not significant	1
	Qualitative	1
U.V. Light	No fluorescence	29
	Same	17
	Slight orange	2
	Yellow/pink color	1
	All fluorescence in long wave UV	1
	Slight fluorescence	1
	Short UV fluorescence	1
	Light yellow fluorescence	1
	A fluorescence orange	1
	B fluorescence blue-white	1
	C fluorescence light orange	1
	Unable to exclude	1
	Short wave green fluorescence	1
	Qualitative	1
	Blue-purple	1
Density	Same or similar	43
	B and C same	3
	A and B same	2
	C greater than A and B	2
	A and C same	1
	B greater than A and C	1
	C less than B	1
	A different	1
	B much less than c, C less than or equal to A	1
	2.244	1
	2.255	1
	2.25	1
	2.258	1
	2.2472	1
	2.20 - 2.33	1
	2.1 g/cc	1

Table 42 (continued)

Method	Response	Number of Labs Reporting this Response
Density (con'd)	2.230 ± .010	1
	2.2614	1
	2.24	1
	2.334 g/ml	1
	.1995 - .42631	1
	B greater than 2.25	1
	A, 2.255	1
	B, 2.254	1
	C, 2.253	1
	A, 1.2581	1
	B, C, 1.2585	1
Thickness	Different	21
	Same or similar	6
	Inconclusive	5
	Irregular surfaces	5
	No parallel edges	2
	N/A	2
	B and C same	2
	Negative	1
	A thicker than B and C	1
	Difference noted but no significance attached	1
	Varies	1
	A and B thicker than C	1
	Unable to exclude	1
	Unequal surfaces	1
	A different, B and C same	1
	Not recorded	1
	No measureable side	1
Physical Match	Does not match	39
	Same	2
	Not possible	2
	2 parallel	1
Elemental Analysis	Same or similar	17
	B and C same	2
	B has more Al	2
	A and C same	1
	A, B contain Cu, C does not	1
	A contains Cd	1
	B contains P, A and C do not	1
	A contains Al	1
	B and C contain trace of Ni	1
	A and C different	1
	A contains more Ni	1
	A contains Ni, B and C do not	1

Table 42 (continued)

Method	Response	Number of Labs Reporting this Response
Elements reported:	main: Si	8
	B	7
	Na	7
	other: As	6
	Li	2
	Al	7
	Cu	2
	Ca	7
	Fe	6
	Mg	7
	Mn	4
	Zr	3
	Ma	1
	Ni	1
	Ti	3
	Zn	1
	Manganese	1
	Tantalum	1
Dispersion Curves	Qualitatively indistinguishable or same	4
	Questionable	1
	A and C same, but not B	1

The following values were given as Dispersion Curve data for items A, B, and C. Due to the fact that no other information was given with respect to units, calculations, methods used, etc., no analysis was performed and only the data reported is presented here.

	Item A	Item B	Item C
	96.98	96.98	96.98
	68.4	78.4	68.4
	1.477	1.477	1.477
at 31°C-39°C	1.480	1.480	1.480
	62.13	62.02	62.24
	.0080	.0079	.0080

Method	Response	Number of Labs Reporting this Response
X-Ray Fluorescence	Same	7
	Samples run directly	1
	A and C same, B different	1
	B and C same, A different	1

Refractive Index (rounded to three decimal places)
Specific values reported for N_d (Sodium Line)

Item A	Frequency
1.475	1
1.476	4
1.477	19
1.478	22
1.479	6
1.480	1
1.484	1
1.487	1

Mean = 1.478
Standard deviation = .0018

Table42 (continued)

Refractive Index (continued)

Item B	Frequency
1.475	1
1.476	4
1.477	18
1.478	21
1.479	8
1.480	1
1.484	1
1.487	1

Mean = 1.478
Standard deviation = .0018

Item C	Frequency
1.474	1
1.476	4
1.477	16
1.478	23
1.479	8
1.480	1
1.484	1
1.487	1

Mean = 1.478
Standard deviation = .0018

Other responses (statistical outliers excluded from above calculations) reported:

Item A	Item B	Item C
1.655	1.655	1.655
1.571	1.571	1.571
57.7	57.7	57.7

Other qualitative responses reported:

Same	7
Different	2
Comparative basis only	2
Very close	1
Specific refractive index not determined	1

FIGURE 16

LAB CODE A__________

PAINT EXAMINATION

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM PAINT EXAMINATION

DATE RECEIVED IN LAB_______

DATE PROCESSED IN LAB ______

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #10A
PAINT EXAMINATION

Item B represents a paint sample removed from the door jamb of a burglarized building. Items A and C represent samples found on the clothing of two different suspects.

1. Could Items A or C have common origin with B?

	ITEM A	ITEM C
YES	☐	☐
NO	☐	☐
INCONCLUSIVE	☐	☐

2. What information (qualitative and quantitative) did you develop to arrive at your conclusions in Question 1? Please check all appropriate boxes and provide values where applicable.

In the left hand column indicate the sequence (1,2,3 etc.) in which the tests were run. Indicate with an asterisk (*) the point where a conclusion was reached, even though subsequent tests were performed for confirmatory purposes.

Sequence of Testing		ITEM A	ITEM B	ITEM C
______	DENSITY STUDIES			
______	EMISSION SPECTROSCOPY (Specify Elements Identified)			
______	FLUORESCENT STUDIES			
______	INFRARED ANALYSIS			
______	MACROSCOPIC EXAMINATION			
______	MICROSCOPIC EXAMINATION			
______	PYROLYSIS G-C			
______	SOLUBILITY TESTS (Specify Solvents Used)			
______	THIN LAYER CHROMATOGRAPHY			
______	UV SPECTROPHOTOMETRY			
______	X-RAY DIFFRACTION			
______	X-RAY FLUORESCENCE (Count Ratio)			
______	OTHER (SPECIFY)			

3. Please specify the information developed with each of the methods and instruments checked in Question 2. (Example: Solubility tests using HCl, H_2SO_4, Acetone and HNO_3). Please provide specific and complete responses. Attach additional sheets if necessary.

Method:

Method:

Method:

4. Additional Comments:

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FOUNDATION OFFICE BY NOVEMBER 26, 1975

The paint samples (test sample #10A) have been characterized by the manufacturer as follows:

The paints were drawn at six mils wet film on glass to yield approximately 120 square inches for each sample. The three samples consist of the following:

Content	Sample A	Sample B	Sample C
TiO_2	3.0 lbs.	3.0 lbs.	2.0 lbs.
ZnO	-	-	1.0 lbs.
Solids Soya Alkyd	-	3.6 lbs.	3.6 lbs.
Solids Acrylic Alkyd	3.6 lbs.	-	-

All have traces of Iron, Zinc, Lead and Cobalt.

Therefore, samples A, B, and C could not have common origin with each other.

This test was designed to ascertain the ability to compare paint samples which were formulated to check both organic and inorganic methodologies. The design of the sample specified that differentiation between the paints could be accomplished by instrumental or chemical means independent of each other.

Paints were drawn down on glass and scraped with teflon coated razor blades when dry.

Problems were encountered in the formulation of the paints when the manufacturer was forced to use a different can of TiO_2 during the run. This caused differences in the trace elements found in the paints. While the differences in these trace elements were insignificant to the paint manufacturer, they were unsuitable for a project of this nature and thus the paints had to be reformulated.

A packaging problem was encountered with this sample (described in the Methods chapter) which necessitated the cancellation of Test #10 and the substitution of Test # 10A (identical materials.)

Table 43

Frequencies of the Reported Methods

Instruments or Methods Used	Number of Laboratories	Percent of total labs (total=110)*
Microscopic Examination	104	94.5%
Solubility Tests	100	90.9%
Macroscopic Examination	94	85.5%
Pyrolysis G-C	57	51.8%
Infrared Analysis	56	50.9%
Fluorescent Studies	43	39.1%
Emission Spectroscopy	39	35.5%
X-ray Fluorescence	26	23.6%
Density Studies	8	7.3%
X-ray Diffraction	7	6.4%
UV Spectrophotometry	4	3.6%
G-C Solid Sampler	2	1.8%
ATR	1	.9%
Color-Marquis	1	.9%
Pyrolysis Infrared	1	.9%
Atomic Absorption	1	.9%
Spot Test	1	.9%
Spectral Reflectance	1	.9%

* Late responses (1) not tabulated.

Table 44

Comparison of Item A and Item B by the Eight Most Frequently Reported Methods

Method	Total Number of Labs Reporting Comparison of Item A and Item B by This Method.	Number of Labs Reporting They Could Differentiate Item A and Item B by This Method.	Number of Labs Reporting They Could Not Differentiate Item A and Item B by This Method.
Microscopic Exam	92	17 (18.5%)	75
Solubility Tests	92	43 (46.7%)	49
Macroscopic Exam	80	5 (6.3%)	75
Pyrolysis G-C	53	50 (94.3%)	3
Infrared Analysis	48	20 (41.7%)	28
Fluorescent Studies	39	2 (5.1%)	37
Emission Spectroscopy	35	7 (20.0%)	28
X-ray Fluorescence	20	4 (20.0%)	16

Table 45

Comparison of Item B and Item C by the Eight Most Frequently Reported Methods

Method	Total Number of Labs Reporting Comparison of Item B and Item C by This Method.	Number of Labs Reporting They Could Differentiate Item B and Item C by This Method.	Number of Labs Reporting They Could Not Differentiate Item B and Item C by This Method.
Microscopic Exam	92	11 (12.0%)	81
Solubility Test	90	28 (31.1%)	62
Macroscopic Exam	80	1 (1.3%)	79
Pyrolysis G-C	51	14 (27.5%)	37
Infrared Analysis	47	3 (6.4%)	44
Fluorescent Studies	39	20 (51.3%)	19
Emission Spectroscopy	37	26 (70.3%)	11
X-ray Fluorescence	21	18 (85.7%)	3

. FIGURE 17

SOIL EXAMINATION

LAB CODE B- ________ __

☐ CHECK HERE AND RETURN IF YOU DO NOT PERFORM SOIL EXAMINATIONS

DATE RECEIVED IN LAB ________

DATE PROCESSED IN LAB ________

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #11
SOIL EXAMINATION

Item A represents a soil sample from a burglary scene. Items B and C represent samples of soil removed from the shoes of two different suspects.

1. Could Items B or C have a common origin with Item A?

	Item B	Item C
Yes	☐	☐
No	☐	☐
Inconclusive	☐	☐

2. What information (qualitative and quantitative) did you develop to arrive at your conclusions in Question 1? Please check all appropriate boxes and provide values where applicable.

   In the left hand column indicate the sequence (1,2,3, etc.) in which the tests were run. Indicate with an asterisk (*) the point where a conclusion was reached, even though subsequent tests were performed for confirmatory purposes. If elemental and/or mineral composition is determined, indicate the elements and/or minerals identified.

Sequence of Testing		ITEM A	ITEM B	ITEM C
________	Color			
________	Density Studies			
________	Microscopic Examination			
________	Emission Spectroscopy			
________	X-Ray Diffraction			
________	X-Ray Spectroscopy			
________	Other (Specify) ________			

3. Please provide the results obtained with each of the methods and instruments checked in Question 2. (Example: Density Gradient tubes using mixture of bromoform and bromobenzene, etc.) Please provide specific and complete responses. Attach additional sheets if necessary

Method:

Method:

Method:

4. Additional Comments

DATA SHEETS MUST BE RECEIVED AT THE FOUNDATION OFFICE BY JANUARY 2, 1976

The soil samples (test samples #11) have been characterized by the manufacturer as follows:

Sample A - Hanford Sandy Loam, Fresno, California

Sample B - Columbia Sandy Loam, Patterson, California
Sample C same

Samples A, B, and C key in the Munsell Soil Color Chart as:

10 YR/5/3 (dry)

10 YR/3/3 (wet)

A may be distinguished from B and C by density gradient and elemental analysis. Therefore, A does not have common origin with B or C.

The principal problem in supplying the soil samples was finding two soils with the same texture and color, but from widely differing geographical locations. The Hilgard Collection in the Department of Soils and Plant Nutrition at the University of California, Berkeley, was the source of both samples. Over a thousand soils were considered before a final selection was made. Finding two soils of virtually the same color is a difficult task.

Upon selection of the two soils, each was screened through an 80-mesh sieve and mixed thoroughly on a mechanical shaker to ensure homogeneity of the individual samples distributed to the participating laboratories. Approximately 500 grams of each soil was mailed to the Forensic Sciences Foundation for packaging and distribution.

Table 46

Frequency of the Reported Methods Used to Answer Question 2

Question 2: What information did you develop to arrive at your conclusions?

Method	Number of Labs Reporting Use of this Method	Percentage of Responding Labs Using this Method*
Color	88	100 %
Microscopic Examination	80	90.9
Density Studies	60	68.2
Emission Spectroscopy	35	39.8
X-ray Spectroscopy	17	19.3
X-ray Diffraction	11	12.5
pH Tests	10	11.4
Microschemical Tests	9	10.2
UV-Fluorescence	6	6.8
Optical Mineralogical Analysis	6	6.8
Particle Size	5	5.7
Ignition Loss	3	3.4
Magnetic Components	3	3.4
Infrared Absorption	2	2.3
UV-Visual Spectroscopy	2	2.3
Turbidometry	2	2.3
Colloidal Suspension	2	2.3
Water Emulsion	1	1.1
Differential Thermal Analysis	1	1.1
Energy Dispersive Analysis	1	1.1
X-ray Light Mineral	1	1.1
Organic Composition	1	1.1
Pyrolysis G-C	1	1.1

* Total (88) does not include responses (5).

Table 47

Comparison of Item A and Item B by the Seven Most Frequently Reported Methods

Method	Number of Labs Comparing Item A and Item B by this Method	Number of Labs Reporting they Could Differentiate Item A and Item B by this Method	Number of Labs Reporting they Could Not Differentiate Item A and Item B by this Method
Color	77	37	40
Microscopic Exam	62	11	51
Density Studies	50	25	25
Emission Spectroscopy	30	2	28
X-ray Spectroscopy	16	6	10
X-ray Diffraction	11	3	8
pH	10	9	1

Table 48

Comparison of Item A and Item C by the Seven Most Frequently Reported Methods

Method	Number of Labs Comparing Item B and Item C by this Method	Number of Labs Reporting they Could Differentiate Item A and Item B by this Method	Number of Labs Reporting they Could Not Differentiate Item A and Item B by this Method
Color	77	37	40
Microscopic Exam	62	11	51
Density Studies	50	27	23
Emission Spectroscopy	30	2	28
X-ray Spectroscopy	16	7	9
X-ray Diffraction	11	3	8
pH	10	9	1

Table 49

Numerical and Sequential Breakdown of the Seven Most Frequently Reported Methods

Method	Number of Labs Using this Method	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Color	88	79	8	0	0	1	0	0
Microscopic Examination	80	6	60	12	1	1	0	0
Density Studies	60	0	7	31	19	0	2	1
Emission Spectroscopy	35	1	0	13	15	5	0	1
X-ray Spectroscopy	16	0	2	7	3	3	1	0
X-ray Diffraction	11	0	1	2	3	4	1	0
pH Tests	10	0	1	2	1	4	2	0

Table 50

Number of Tests Performed to Reach a Conclusion

Step	Number of Conclusions Reached at this Step	Cumulative Percent (68 Labs)
1	17	25.0%
2	6	8.8
3	21	30.9
4	17	25.0
5	5	7.4
6	0	0
7	1	1.5
8	1	1.5

Note: 20 Labs did not report the point where a conclusion was reached. (i.e., no * shown)

Table 51

Number of Conclusions Reached From Each of the Seven Most Frequently Used Methods

Method	Number of Conclusions Reached From this Method
Color	15
Microscopic Examination	4
Density Studies	20
Emission Spectroscopy	7
X-ray Spectroscopy	3
X-ray Diffraction	1
pH Tests	2

Table 52

Elements Reported by Participating Labs

Elements	Number of Labs Which Reported Finding the Elements in a Sample
Al (Aluminium)	22
As (Arsenic)	1
B (Boron)	1
Ba (Barium)	1
C (Carbon)	1
Ca (Calcium)	23
Cd (Cadmium)	1
Cl (Chlorine)	2
Co (Cobalt)	1
Cr (Chromium)	4
Cu (Copper)	8
Fe (Iron)	26
Ga (Galium)	1
Ir (Iridium)	1
K (Potassium)	13
Mg (Magnesium)	20
Mn (Manganese)	15
Mo (Molybdenum)	1
Na (Sodium)	17
Ni (Nickel)	3
O (Oxygen)	11
Os (Osmium)	1
Pb (Lead)	4
Rb (Rubidium)	3
Rh (Rhodium)	1
Ru (Ruthenium)	1
S (Sulfur)	3
Sb (Antimony)	
Si (Silicon)	26
Sr (Strontium)	7
Ti (Titanium)	20
V (Vanadium)	6
Y (Yttrium)	1
Zn (Zinc)	7
Zr (Zirconium)	9

Note: 28 laboratories reported specific elements that they had found in the samples.

PROFICIENCY TESTING

FIGURE 18

LAB CODE B ____________

FIBER EXAMINATION

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM FIBER EXAMINATION

DATE RECEIVED IN LAB ____________

DATE PROCESSED IN LAB ____________

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #12
FIBER EXAMINATION

Item C represents fibers from the scene of a homicide. Items A and B represent fibers found on the shoes of two different suspects.

1. Could Items A or B have common origin with C?

	ITEM A	ITEM B
YES	☐	☐
NO	☐	☐
INCONCLUSIVE	☐	☐

2. What information (qualitative and quantitative) did you develop to arrive at your conclusions in Question 1? Please check all appropriate boxes and provide values where applicable.

In the left hand column indicate the sequence (1, 2, 3, etc.) in which the tests were run. Indicate with an asterisk (*) the point where a conclusion was reached, even though subsequent tests were performed for confirmatory purposes.

Sequence of Testing		ITEM A	ITEM B	ITEM C
________	BIREFRINGENCE			
________	EMISSION SPECTROSCOPY (Specify Elements Identified)			
________	FLUORESCENT STUDIES			
________	INFRARED ANALYSIS			
________	MACROSCOPIC EXAMINATION			
________	MELTING POINT DETERMINATION			
________	MICROSCOPIC EXAMINATION (Specify Type)			
________	PYROLYSIS G-C			
________	REFRACTIVE INDEX			
________	SOLUBILITY TESTS (Specify Solvents Used)			
________	THIN LAYER CHROMATOGRAPHY			
________	UV SPECTROPHOTOMETRY			
________	X-RAY DIFFRACTION			
________	X-RAY FLUORESCENCE (Count Ratio)			
________	OTHER (SPECIFY) ________			
________	________			
________	________			

3. Please specify the information developed with each of the methods and instruments checked in Question 2. (Example: Solubility tests using HCl, H_2SO_4, Acetone and HNO_3; microscopic-fibers identified as cotton, nylon, etc.)

   Please provide specific and complete responses. Attach additional sheets if necessary.

   Method:

   Method:

   Method:

4. Additional Comments:

DATA SHEETS MUST BE RECEIVED AT THE
FOUNDATION OFFICE BY FEBRUARY 10, 1976

The Fibers (test samples #12) can be characterized according to the sample manufacturer as follows:

Item A - Composition: 100% wool
Manufacturer: Philadelphia Carpet Company
Color: Heather Green

Item B - Composition: Acrylic (70% acrylic + 30% modacrylic)
Manufacturer: Brinkcrest Company
Color: #1014 Avocado

Item C - Composition: 100% Dacron Polyester
Manufacturer: Burlington Industries
Color: #31 Pine

Three different fiber specimens were submitted. The specimens were deliberately small in quantity to duplicate the sample size generally found in casework.

Fibers were pulled directly out of carpet samples, placed in folded glassine paper and inserted into coin envelopes.

One specimen was 100% wool; the other two were different synthetics. Fiber size and color were selected as nearly as possible to being the same to the naked eye. The test was so designed that macroscopic examination would probably not differentiate the samples. However, a thorough microscopic examination would indicate differences in the fibers. Also, these differences could be detected by several other analytical methods available in some of the laboratories, and those laboratories which conducted that thorough of an examination could be be expected to identify the specific fibers.

Difficulty was encountered in obtaining specimens close in color and size, which would also have sufficiently different characteristics that a simple microscopic examination could tell them apart. It was desirable that phase contrast microscopy, polarized light, dark field illumination, etc., would need to be used.

Of interest was the high percentage of correct results which were reached by several different methods of examination. Subsequent tests should use the same type of fibers from different sources which would be more difficult to differentiate than in the mere elimination process that was required here.

Table 53

FREQUENCY OF THE REPORTED METHODS USED TO ANSWER QUESTION 2

Question 2: What information did you develop to arrive at your conclusions?

Method	Number of Reported Use of this Method	Percentage of Responding Labs Using this Method*
Microscopic Examination	121**	N/A**
Macroscopic Examination	84	71.8%
Solubility Test	55	48.2%
Birefringence	46	40.4%
Melting Point Determination	20	17.1%
Refractive Index	19	16.7%
Fluorescent Studies	13	11.1%
Infrared Analysis	10	9.4%
Flame Test	2	1.7%
Density Studies	1	.9%
Thin-layer Chromatography	1	.9%
Dupont I.D. Stain #4	1	.9%
Thermal Depolarization Analysis	1	.9%
Color Test	1	.9%
UV Spectrophotometry	1	.9%
Diameter of Fibers	1	.9%

* Total (117) does not include late responses (3).

**Some Laboratories reported more than one microscopic examination in response to Question 2. 113 different Labs did some kind of microscopic examination

Table 54

Comparison of Items A and C by the Eight Most Frequently Reported Methods

Method	Number of Labs Comparing Item A and Item C by this Method	Number of Labs Reporting they Could Differentiate Item A from Item C by this Method	Number of Labs Reporting they Could Not Differentiate Item A from Item C by this Method
Microscopic Exam	108	108	0
Macroscopic Exam	56	38	18
Solubility Tests	26	22	4
Birefringence	22	19	3
Melting Point Determination	10	10	0
Refractive Index	4	4	0
Fluorescent Studies	8	3	5
Infrared Analysis	3	2	1

Table 55

Comparison of Items B and C by the Eight Most Frequently Reported Methods

Method	Number of Labs Comparing Item B and Item C by this Method	Number of Labs Reporting they Could Differentiate Item B from Item C by this Method	Number of Labs Reporting they Could Not Differentiate Item B from Item C by this Method
Microscopic Exam	107	99	8
Macroscopic Exam	56	20	36
Solubility Tests	45	39	6
Birefringence	36	33	3
Melting Point Determination	19	19	0
Refractive Index	16	16	0
Fluorescent Studies	10	5	5
Infrared Analysis	9	9	0

Table 56

Numerical and Sequential Breakdown of the Eight Most Frequently Reported Methods

Method	Number of Labs Using this Method	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
Microscopic Examination	121*	30	79	8	2	0	1	0	1
Macroscopic Examination	83	80	3	0	0	0	0	0	0
Solubility Tests	55	0	9	26	13	5	2	0	0
Birefringence	46	2	12	17	10	3	2	0	0
Melting Point Determination	20	0	1	7	6	3	2	1	0
Refractive Index	19	0	1	6	7	5	0	0	0
Fluorescent Studies	13	1	5	4	3	0	0	0	0
Infrared Analysis	10	1	1	4	2	1	0	1	0

*Some Labs reported more than one microscopic examination.

Table 57

Number of Tests Performed to Reach a Conclusion

Step	Number of Conclusions Reached at this Step
1	20
2	71
3	16
4	5
5	1
6	1

Note: 15 Labs did not report the point where a conclusion was reached (i.e., no * shown)
Also, some Labs reported more than one asterisk

Table 58

Number of Conclusions Reached from Each of the Eight Most Frequently Used Methods

Method	Number of Conclusions Reached on this Method
Microscopic Examination	79
Macroscopic Examination	6
Solubility Tests	7
Birefringence	11
Melting Point Determination	3
Refractive Index	2
Fluorescent Studies	1
Infrared Analysis	4

LAB CODE B__________

CHECK HERE (AND RETURN) IF YOU DO NOT DO PHYSIOLOGICAL FLUID EXAMINATION.

DATE RECEIVED __________
DATE PROCESSED __________

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #13
PHYSIOLOGICAL FLUID EXAMINATION

Items A and B represent evidence collected in connection with a rape case. Please examine the items according to your normal laboratory procedures and complete portion(s) which comply with your laboratory policy. Please add any additional information you consider pertinent to your response.

1a. The stain on Item A (Blue Cloth):

☐ was examined with inconclusive results
☐ was examined and determined ☐ tentatively as representing a __________ stain.
☐ conclusively

1b. The following tests were conducted to arrive at the answer to question 1a:

☐ Microscopic examination
☐ Phase contrast
☐ Bright field (specify stains used) __________
____
____

☐ Acid phosphatase determination
specify substrate: __________ specify dye: __________
__________ __________
__________ __________

☐ Starch amylase
☐ Microcrystalline (specify) __________
____
____

☐ Blood group determination (specify factors sought, and methods used).

Factors: Methods used:
__________ __________
__________ __________
__________ __________

☐ Other (specify) __________
____
____

(OVER)

2a. The stain on Item B (Pink Cloth):

☐ was examined with inconclusive results
☐ was examined and determined ☐ tentatively as representing a __________ stain
☐ conclusively

2b. The following tests were conducted to arrive at the answer to question 2a:

☐ Microscopic examination
☐ Phase contrast
☐ Bright field (specify stains used) __________
____
____

☐ Acid phosphatase determination
specify substrate: __________ specify dye: __________
__________ __________
__________ __________

☐ Starch amylase
☐ Microcrystalline (specify) __________
____
____

☐ Blood group determination (specify factors sought, and methods used).

Factors: Methods used:
__________ __________
__________ __________
__________ __________

☐ Other (specify) __________
____
____

3. Additional Comments:

FIGURE 19
PHYSIOLOGICAL FLUID

The stains (test samples #13) are characterized by the manufacturer as follows:

Item A: (Blue Cloth) is stained with saliva from a Type A secretor individual

Item B: (Pink Cloth) is stained with seminal fluid from a Type A secretor individual with a normal sperm count.

The saliva stain was deposited on clean cloth by touching a swatch of cloth previously cut into 2-inch squares, to the tongue of the donor. Approximately 20 stains were deposited at a time. After 20 stains, however, a period of time was necessary to generate more saliva.

Plastic gloves were worn while handling the cloth swatches. The stains were allowed to dry at room temperature for 24 hours on a sheet of polyethylene. They were then packaged in manila envelopes and mailed to the Forensic Sciences Foundation. The cloth was color coded (blue) to distinguish the saliva stain and the semen stain (pink). If this experiment were attempted in the future, the approach used in this test sample would appear to be adequate and satisfactory.

To manufacture approximately 250 samples for the semen test, the volume of semen that is necessary exceeds that which is produced in the normal volume of ejaculate. At the same time it was felt that the homogeneity of the total sample was critical to ensure that each laboratory is given identical samples insofar as possible. The semen was pooled from three separate ejaculations. All three ejaculations were collected within a 12 hour period, the first and second consecutive ejaculates being stored at 4° C after collection. Following the third ejaculation, the pooled sample was allowed to liquify for approximately one hour at 4°C. Microscopic examination of a small aliquot showed a normal sperm count. The sample was then stirred to insure homogeneity, and two drops were deposited on 2-inch squares of clean cotton cloth spread on a polyethylene sheet. The stains were allowed to air dry for 24 hours at room temperature, packaged in a manila envelope and, with the package of saliva stains, mailed on the same day to the Forensic Sciences Foundation. If this experiment were attempted in the future, the approach used in this test sample would appear to be adequate and satisfactory.

Table 59

Frequency of the Methods Reported in Response to Question 1b

Question 1b: The following tests were conducted to arrive at the answer to Question 1a (regarding the origin of Item A):

Method	Number of Reported Uses of this Method	Percentage of Responding Labs Using this Method*
Acid Phosphatase Determination	98	76.6%
Microscopic Examination	77	60.2%
Bright Field	37	28.9%
Phase Contrast	15	11.7%
Starch Amylase	74	57.8%
Blood group Determination	61	47.7%
Microcrystalline	19	14.8%

Table 60

Frequency of the Methods Reported in Response to Question 2b

Question 2b: The following tests were conducted to arrive at the answer to Question 2a (regarding the origin of Item B):

Method	Number of Reported Uses of this Method	Percentage of Responding Labs Using this Method*
Acid Phosphatase Determination	120	93.8%
Microscopic Examination	109	85.2%
Bright Field	62	48.4%
Phase Contrast	37	30.9%
Blood Group Determination	84	65.6%
Microcrystalline	47	36.7%
Starch Amylase	30	23.4%

* Total (128) does not include late responses (1).

Table 61

Summary of Responses to Question 1a of Those Labs Reporting Use of Starch Amylase Determination in Question 1b

Response	Number of Labs Reporting this Response
Inconclusive	8
Saliva, tentatively	43
Saliva, conclusively	21
Vaginal, conclusively	1
Non-seminal	1

Table 62

Summary of Responses to Question 1a of Those Labs Not Reporting Use of Starch Amylase Determination in Question 1b

Response	Number of Labs Reporting this Response
Inconclusive	29
Saliva, tentatively	4
Saliva, conclusively	2
Non-seminal	15
Vaginal, tentatively	1
Vaginal, conclusively	1
No Response	2

Table 63

Stains Used by Those Laboratories Reporting Bright Field as a Response to Question 1b or 2b

Stain	Number of Reported Responses in Question 1b	Number of Reported Responses in Question 2b
Kernechtrot & Picroindigocarmine	8	13
Gram's Stain	4	5
Carboleosin Fuchsin	4	3
Baecchis	3	2
Hematoxylin/Eosin	3	6
Gentian Violet	1	4
Crystal Violet	2	2
Hematoxylin	1	1
Giemsa Stain	1	1
Aceto-orcein	2	1
Wright	1	2
Methylene Blue and Eosin	1	1
Methylene Blue	1	1
Basic Fuchsin	1	2
Lugol's Stain	1	1
Methylene Blue & Basic Fuchsin	0	1
Saffranin	0	2
Eosin	0	2
Phenosaffrine	0	1
Papanicolaou	0	1
No Staining	2	4

Table 64

Substrates and Dyes Used by Those Laboratories Reporting Acid Phosphatase Determination As a Response to Question 1b or 2b

Substrate	Number of Labs Reporting Use of this Substrate in 1b	Number of Labs Reporting Use of this Substrate in 2b
α- naphthyl Phosphate	83	102
Thymolphthalein Monophosphate	4	5
Walker	3	4
Phosphatesmo KM	2	2
SAP	1	1
4-methylumbelliferyl Phosphate	1	1
p-nitrophenyl Phosphate	1	1
Phosphatabs Acid	0	3
Disodium Monophenyl Phosphate	0	2

Dye	Number of Labs Reporting Use of this Dye in Response to Question 1b	Number of Labs Reporting Use of this Dye in Response to Question 2b
Brentamine Fast Blue B	50	60
Anthraquinone 1-diazonium chloride	13	16
Naphthanil Diazo Red AL	6	8
Diazo Blue	5	6
Tetrazotized o-Dianisidine	5	10
Fast Navy Blue RA	3	3
Diazo Red RC	3	4
Fast Red AL	2	2
Diazotized 5-nitro anisidine	2	2
Folin-Ciocalteau	0	1

Table 65

Type of Microcrystalline Tests Performed by Those Laboratories Reporting Microcrystalline Tests as a Response to Question 1b or 2b

Test	Number of Labs Reporting this Test in Question 1b	Number of Labs Reporting this Test in Question 2b
Florence Test	17	44
Barberios	4	1
Choline	3	1
Lugol's	0	1
Tetramethylbenzidine	1	0

FIGURE 20

ARSON EXAMINATION

LAB CODE B__________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM ARSON EXAMINATION

DATE RECEIVED IN LAB______

DATE PROCESSED IN LAB______

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #14
ARSON EXAMINATION

Item B represents a piece of evidence found at the scene of an attempted arson. Items A & C were found in the back seat of a fleeing motor vehicle minutes after a silent alarm was activated at police headquarters.

1. a. Could Items A or C have common origin with Item B?

	A	C
Yes	☐	☐
No	☐	☐
Inconclusive	☐	☐

b. Does the evidence denote a conspiracy?

Yes ☐
No ☐
Inconclusive ☐

2. What information (qualitative, quantitative and criminalistic) did you develop to arrive at your conclusion in Question 1? List the order of tests performed. Asterisk (*) the point at which a conclusion or conclusions were reached.

Sequence of Testing	Information Developed
1.	
2.	
3.	
4.	
5.	

3. a. Was an accelerant found? Yes ☐ No ☐
b. If "Yes", was it identified? Yes ☐ No ☐
Identified as:______________

- Over -

4. Please specify the information developed with each of the methods and instruments used.

Please provide specific and complete responses. Attach additional sheets if necessary.

Method:

Method:

Method:

Method:

5. Additional Comments:

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OFFICE BY APRIL 23, 1976

The arson examination sample (test samples #14) is characterized by the manufacturer as follows:

Item A	Contained approximately 8 ml of leaded gasoline Chevron Supreme (High test) 94.5 Octane
Item B	A portion of a 8" square of 100% white cotton cloth purchased at J.C. Penney's with 2 ml of Item A absorbed thereon.
Item C	The other portion of the 8" square used in Item B.

The cloth in B and C was cut with scissors. Therefore:

- Gasoline of Item A exhibits all the same characteristics as the gasoline of Item B.
- Cloth of Item B is an exact fit to the cloth of Item C and at one time was a single unit.

Various problems were encountered in the manufacture of this sample as well as the construction of the test questions. The packaging originally chosen for the gasoline sample, a 4 oz. metal paint can proved to be inadequate for the purposes intended. Lids blew off shortly after placing the gasoline in them, necessitating finding an alternate type of container for the volatile fluid (glass vials with screw tops were chosen) and resulting in the delay of the distribution of the sample.

One of the questions posed regarded evidence of a conspiracy and was later judged to be inappropriate for this type of test and was not tabulated in the test results. The intent or question as posed was to determine whether or not the laboratories were able to determine that cloth swatches were originally one piece and that the gasoline samples were from a common source. However, the demonstration of conspiracy is a legal question and one that is best answered by the courts.

Table 66

Frequency of the Methods Reported in Response to Question 2

Question 2: What information did you develop to arrive at your conclusion in Question 1?

Method	Number of Labs Reporting Use of this Method	Percentage of Responding Labs Using this Method*
Gas Chromatography	110	96.5%
Fabric & Cut Examinations	105	92.1%
Odor	45	39.5%
Infrared	28	24.6%
Flammability Tests	18	15.8%
Fluorescent Tests	9	7.9%
Thin layer Chromatography	6	5.3%
Hydrocarbon Detector	4	3.5%
Dye Staining	4	3.5%
Energy Dispersive X-ray	3	2.6%
Flash Point Tests	3	2.6%
Atomic Absorption	2	1.8%
Color Tests	2	1.8%
Refractive Index	1	.9%
Solubility	1	.9%
Nuclear Magnetic Resonance	1	.9%
S. P. F.	1	.9%

* Total (114) does not include late responses (4).

LAB CODE B________

FIGURE 21

DRUG EXAMINATION

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM DRUG ANALYSIS

DATE RECEIVED IN LAB____________

DATE PROCESSED IN LAB____________

DATA SHEET

PROFICIENCY TESTING PROGRAM

TEST #15

DRUG ANALYSIS

1. The enclosed substance was a street buy. The agent needs all the qualitative and quantitative information you can provide.

2. Indicate method (s) used:

The drug sample (test sample #15) is characterized by the manufacturer as follows:

Component	Composition by Weight	% Composition
dl Methamphetamine HCl	3.0 grams	1%
Ephedrine Sulfate	3.0 grams	1%
Lactose	147 grams	49%
Sodium Carbonate (Annhydrous)	147 grams	49%
	300 grams	100%

This drug sample was designed primarily to ascertain whether the laboratories were able to differentiate between methamphetamine and amphetamine. Materials which were used as diluents were chosen because they would or could interfere with the ultraviolent absorption and the color tests that were performed.

Originally it had been intended that this drug sample be packaged in an easily recognizable commercial pharmaceutical capsule. However, difficulties in obtaining these capsules required that the material be packaged in clear gelatin capsules.

Table 67

Summary of Responses to Question 1

Question 1: The enclosed substance was a street buy.

The agent needs all the qualitative and quantitative information you can provide.

A) Diluents:

Diluent found	Number of Laboratories Reporting this Response	% of Responding Labs (N=146)
Sugar only	14	9.6%
Carbonate only	23	15.8%
Sugar and Carbonate	46	31.5%
Total Labs Reporting Cutting Agents	83	56.8%

B) Controlled Substances:

Controlled Substance Found	Number of Labs Reporting this Response	% of Responding Labs
Methamphetamine only	31	21.2%
Ephedrine only	17	11.6%
None	7	4.8%
Other Amphetamines	4	2.7%
Methamphetamine and Ephedrine	87	59.6%
Total	146	100.0%

168

Table 68

Frequency of Reported Methods

Method	Number of Labs Reporting Use of this Method	Percentage of Labs Reporting Use of this Method
Chemical Tests	127	87.0
UV Spectroscopy	115	78.8
Gas Chromatography	103	70.5
Thin-layer Chromatography	96	65.8
Microcrystalline Tests	65	44.5
Infrared Analysis	61	41.8
GC/Mass Spectroscopy	33	22.6
Extraction	16	11.0
X-ray Diffraction	11	7.5
pH	9	6.2
Microscopic Examination	9	6.2
Fluorescent Studies	4	2.7
Emission Spectroscopy	3	2.1
Melting Point	2	1.4
Paper Chromatography	1	.7
Flame Test	1	.7
Derivitization	1	.7
Micro-diffusion	1	.7
Phenylisothiocyanate Derivatives	1	.7

FIGURE 22
PAINT EXAMINATION

LAB CODE ____________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM PAINT EXAMINATION

DATE RECEIVED IN LAB________

DATE PROCESSED IN LAB ______

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST # 16
PAINT EXAMINATION

Item B represents a paint sample removed from the door jamb of a burglarized building. Items A and C represent samples found on the clothing of two different suspects.

1. Could Items A or C have common origin with B?

	ITEM A	ITEM C
YES	☐	☐
NO	☐	☐
INCONCLUSIVE	☐	☐

2. What information (qualitative and quantitative) did you develop to arrive at your conclusions in Question 1? Please check all appropriate boxes and provide values where applicable.

In the left hand column indicate the sequence (1,2,3 etc.) in which the tests were run. Indicate with an asterisk (*) the point where a conclusion was reached, even though subsequent tests were performed for confirmatory purposes.

Sequence of Testing		ITEM A	ITEM B	ITEM C
______	DENSITY STUDIES			
______	EMISSION SPECTROSCOPY (Specify Elements Identified)			
______	FLUORESCENT STUDIES			
______	INFRARED ANALYSIS			
______	MACROSCOPIC EXAMINATION			
______	MICROSCOPIC EXAMINATION			
______	PYROLYSIS G-C			
______	SOLUBILITY TESTS (Specify Solvents Used)			
______	THIN LAYER CHROMATOGRAPHY			
______	UV SPECTROPHOTOMETRY			
______	X-RAY DIFFRACTION			
______	X-RAY FLUORESCENCE (Count Ratio)			
______	OTHER (SPECIFY)			

3. Please specify the information developed with each of the methods and instruments checked in Question 2. (Example: Solubility tests using HCl, H_2SO_4, Acetone and HNO_3). Please provide specific and complete responses. Attach additional sheets if necessary.

Method:

Method:

Method:

4. Additional Comments:

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FOUNDATION OFFICE BY AUGUST 9,1976

The paint samples (test sample #16) are characterized by the suppliers as follows:

> The paints are drawn at six mils wet film on glass to yield approximately 120 square inches for each sample. The three samples consist of the following:

Content	Sample A	Sample B	Sample C
TiO_2	3.0 lbs.	3.0 lbs.	2.0 lbs.
ZnO	-	-	1.0 lbs.
Solids Soya Alkyd	-	3.6 lbs.	3.6 lbs.
Solids Acrylic Alkyd	3.6 lbs.	-	-

> All have traces of Iron, Zinc, Lead and Cobalt.
>
> Samples A, B, and C could not have common origin with each other.

Test Sample #16 is the same formulation as was presented in Test #10A with the sole difference being the pigment used. The rationale for conducting this test was to compare results with 10A to check improvements or other changes in performance.

Table 69

FREQUENCY OF REPORTED METHODS USED TO ANSWER QUESTION 2

Question 2: What information did you develop to arrive at your conclusion?

Method	Number of Reported Uses of This Method	% of Responding Labs Using This Method*
Microscopic Examination	95	93.1%
Macroscopic Examination	88	86.3%
Solubility Tests	87	85.3%
Pyrolysis G-C	61	59.8%
Infrared Analysis	48	47.1%
Emission Spectroscopy	35	34.3%
Fluorescent Studies	31	30.4%
X-ray Fluorescence	22	21.6%
X-ray Diffraction	14	13.7%
Thin Layer Chromatography	14	13.7%
UV Spectrophotometry	8	7.8%
Density Studies	4	3.9%
Visible Spectrophotometry	2	2.0%
Microchemical	2	2.0%
EDAX	1	1.0%
Energy Dispersive Spectroscopy	1	1.0%
Thermogravimetric Analysis	1	1.0%
Polarizing Microscopy	1	1.0%
Scanning Electron Microscope	1	1.0%
Spectral Reflectance	1	1.0%
GC of Binder Extract	1	1.0%

* Total (102) does not include late responses (1).

Table 70

Comparison of Item A and Item B by the Eight Most Frequently Reported Methods

Method	Total Number of Labs Reporting Comparison of Item A and Item B by This Method.	Number of Labs Reporting They Could Differentiate Item A and Item B by This Method.	Number of Labs Reporting They Could Not Differentiate Item A and Item B by This Method.
Macroscopic Exam	73	12	61
Microscopic Exam	85	11	74
Solubility Tests	75	24	51
Pyrolysis G-C	53	50	3
Infrared Analysis	42	22	20
Emission Spectroscopy	27	6	21
Fluorescent Studies	25	0	25
X-ray Fluorescence	17	8	9

Table 71

Comparison of Item B and Item C by the Eight Most Frequently Reported Methods

Method	Total Number of Labs Reporting Comparison of Item B and Item C by This Method.	Number of Labs Reporting They Could Differentiate Item B and Item C by This Method.	Number of Labs Reporting They Could Not Differentiate Item B and Item C by This Method.
Macroscopic Exam	73	5	68
Microscopic Exam	82	10	82
Solubility Tests	69	14	55
Pyrolysis G-C	49	17	32
Infrared Analysis	34	9	25
Emission Spectroscopy	32	31	1
Fluorescent Studies	25	12	13
X-ray Fluorescence	20	20	0

LAB CODE ________

FIGURE 23

METAL EXAMINATION

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM METAL EXAMINATION

DATE RECEIVED IN LAB ______

DATE PROCESSED IN LAB ______

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #17
METAL EXAMINATION

Items A, B, and C represent metal samples submitted in connection with a criminal case.

1. a) Could Items A and B have a common origin?

   ☐ Yes

   ☐ No

   ☐ Inconclusive

   b) Could Items A and C have a common origin?

   ☐ Yes

   ☐ No

   ☐ Inconclusive

   c) Could Items B and C have a common origin?

   ☐ Yes

   ☐ No

   ☐ Inconclusive

2. What tests were employed to answer Question 1? (Please be specific, e.g. emission spectroscopy, energy dispersive X-Ray, etc.) Use page 4 if additional space is required.

   a. ________________________________

   b. ________________________________

   c. ________________________________

   d. ________________________________

3. Please report any elemental data (both qualitative and quantitative) developed in the analysis of Items A, B, and C. Report quantitative data in either % by weight or ppm. Indicate which instrumental techniques identified each element reported.

ITEM A			ITEM B			ITEM C		
Element	Instrument	Quantity	Element	Instrument	Quantity	Element	Instrument	Quantity

4. If particular elements were sought but found not to be present in Items A, B, and C, please indicate those elements below.

ITEM A		ITEM B		ITEM C	
Element	Instruction	Element	Instruction	Element	Instruction

The metal samples are characterized by the manufacturer as follows:

Item A:	National Bureau of Standards Standard Reference Material 362, AISI 94B17 Steel (Modified)
Items B & C:	National Bureau of Standards Standard Reference Material 19G, Acid Open Hearth Steel, 0.2% Carbon

The chemical composition (nominal weight percent) of the materials is as follows:

	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co	Ti	As
Item A	.160	1.04	.014	.038	.39	.50	0.59	.30	.040	.068	(.20)	.30	(.084)	(.079)
Items B&C	0.223	.554	.046	.033	.186	.093	.066	.374	.012	.013	-	0.012	0.027	--

	Sn	Al	Nb	Ta	Zr	N	B	Pb	Sb	Bi	Ag	Se	Te	Ce
Item A	(.016)	(.086)	(.28)	(.20)	(.21)	(.0040)	(.0025)	(.0006)	.013	(.006)	(.0009)	(.001)	(.001)	(.002)
Items B&C	0.008	.031	0.026	-	-	-	-	-	-	-	-	-	-	-

	La	Nd	Ca	Mg	Zn	Pr	Ge	O	H	Au	Hf
Item A	(.0005)	(.0005)	(.0003)	(.0007)	(.001)	(.0003)	(.002)	(.001)	(<.0005)	(<.00006)	(.0040)
Items B&C	-	-	-	-	-	-	-	-	-	-	-

Note: Values in parenthesis not certified, based on a single analytical method.

The metals were selected out of the National Bureau of Standards' Standard Reference Material Catalogue. They were purchased from NBS in sufficient quantities for distribution to the laboratories, then packaged and mailed from the Foundation office.

Table 72

Frequency of Reported Methods

Method	Number of Labs Reporting Use of this Method	Percentage of Responding Labs Reporting Use of this Method (Total = 68)
Emission Spectroscopy	40	58.8%
Energy Dispersive X-ray	25	36.8%
Microscopic Examination	11	16.2%
Chemical Tests	11	16.2%
X-ray Fluorescence	7	10.3%
Magnetic	7	10.3%
Macroscopic Exam	5	7.4%
X-ray Diffraction	2	2.9%
Atomic Absorption	2	2.9%
NAA	1	1.5%
UV-Visible Spectrophotometry	1	1.5%

Table 73

Frequency of Reported Elements

Elements	Number of Labs Reporting Presence of Element in Item A	Number of Labs Reporting Presence of Element in Items B & C
Iron	54	54
Nickel	47	38
Manganese	46	48
Chromium	45	48
Copper	43	39
Titanium	23	19
Cobalt	21	12
Zirconium	21	2
Niobium	21	11
Aluminum	20	20
Silicon	19	19
Molybdenum	14	14
Tin	13	12
Magnesium	11	11
Silver	9	6
Arsenic	9	4
Calcium	6	6
Lead	6	5
Vanadium	6	5
Zinc	5	6
Antimony	4	4
Tungsten	3	2
Carbon	2	1
Bromine	2	2
Lanthanum	2	2
Tantalum	2	1
Potassium	2	2
Palladium	1	1
Phosphorus	1	1
Sulfur	1	1
Bismuth	1	0
Germanium	1	1
Cesium	1	1

FIGURE 24
HAIR EXAMINATION

LAB CODE ____________

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM HAIR EXAMINATION

PROFICIENCY TESTING

DATE RECEIVED IN LAB __________

DATE PROCESSED IN LAB __________

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST SAMPLE #18
HAIR EXAMINATION

The hair samples A, B, C, D and E were collected in connection with a criminal investigation.

1. Please provide species origin for each hair sample.

Sample A

Sample B

Sample C

Sample D

Sample E

2. Please specify the methods used to answer question 1.

1.

2.

3.

- Over -

3. Does your laboratory have a reference collection of hairs?

☐ Yes ☐ No

If "Yes", is this your own "in-house" collection or a commercially available collection?

☐ "in-house" ☐ commercial

Please specify__________________

4. Additional Comments:

DATA SHEETS MUST BE POSTMARKED BY OCTOBER 31, 1976

The hair samples are characterized by the manufacturer as follows:

Item A	Dog
Item B	Cat
Item C	Deer
Item D	Cow
Item E	Mink

The decision to use hair as a sample type was made because it is encountered in many laboratory investigations. The rationale for the choices of hair specimens was based on the following:

1) Dog and Cat hairs because they are commonly encountered domestic animals;

2) Mink hair because it is often encountered in stolen property;

3) Cow hair because it is encountered in livestock theft which is a prominent crime in many areas;

4) Deer hair because it is encountered in crimes such as hit-and-run accidents and shooting animals out of season.

The hair from the domestic animals (dog and cat) was obtained from the pets of employees. The mink hair was obtained from a local mink farm. The cow hair was obtained from a local processing meat packing house, and the deer hair came from a freshly killed animal from the game department.

The major problem encountered in the packaging of the hairs was ensuring that there were both bristle (guard) and wool hairs amongst each sample that was packaged.

The hairs were placed in glassine envelopes and sealed. They were then placed in brown manila envelopes, marked and sent to the Forensic Sciences Foundation.

Table 74

Summary of Responses to Question 1* for Sample A

Response	Number of Laboratories giving Response
dog	44
cow	6
bear	5
horse	2
cat	2
rat	2
skunk	1
non-human	17
inconclusive	8
no response	3

Table 75

Summary of Responses to Question 1* for Sample B

Response	Number of Laboratories giving Response
cat	66
dog	3
mouse	1
squirrel	1
fox	1
non-human	13
inconclusive	2
no response	3

Table 76

Summary of Responses to Question 1* for Sample C

Response	Number of Laboratories giving Response
deer	41
elk	13
horse	9
goat	5
cow	2
pig	1
dog	1
non-human	10
inconclusive	4
no response	4

*Question 1: Please provide species origin for each hair sample.

Table 77

Summary of Responses to Question 1* for Sample D

Response	Number of Laboratories giving Response
cow	31
dog	19
horse	10
human	3
opossum	1
wool	1
alpaca or llama	1
sheep or rodent or dog	1
non-human	12
inconclusive	7
no response	4

Table 78

Summary of Responses to Question 1* for Sample E

Response	Number of Laboratories giving Response
mink	57
cat	4
rat	4
rabbit	4
mouse	3
squirrel	2
non-human	12
no response	4

*Question 1: Please provide species origin for each hair sample.

Table 79

Summary of Responses to Question 2

Question 2: Please specify the methods used to answer Question 1.

Method	Number of Labs Reporting Use of this Method
Microscopic*	88
Macroscopic	9
No Response	2

*Microscopic refers to use of any one or more of various types of microscopic examinations

LAB CODE ______________

FIGURE 25
WOOD EXAMINATION

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM WOOD EXAMINATION

DATE RECEIVED IN LAB________

DATE PROCESSED IN LAB_______

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #19
WOOD EXAMINATION

Items A, B, and C represent wood samples submitted in connection with a criminal case.

1. a) Could Items A and B have a common origin?

   ☐ Yes
   ☐ No
   ☐ Inconclusive

   b) Could Items A and C have a common origin?

   ☐ Yes
   ☐ No
   ☐ Inconclusive

   c) Could Items B and C have a common origin?

   ☐ Yes
   ☐ No
   ☐ Inconclusive

2. Please indicate species for:

   Item A ____

   Item B ____

   Item C ____

(over)

3. Please indicate methods used:

☐ Simple magnifier Magnification______________

☐ Compound microscope Magnification______________

 ☐ Transmitted light

 ☐ Reflected light

☐ Other (please specify) ____________________________________

____

4. Additional comments:

The wood samples are characterized by the manufacturer as the following:

Item A - Abies grandis. Fir

Whitish to yellowish brown, straight grained, with no characteristic odor or taste. Growth rings distinct. Parenchyma not apparent with unaided eye. Rays very fine, not distinct with unaided eye. Resin canals absent (cross section). Tracheids average 30-50 microns in diameter. Diffuse porous vessels (cross section). Intervessel pits linear. Pit apertures markedly elongated in the horizontal direction across a vessel element (tangential section, pulp). Parenchyma arrangement apotracheal. Parenchyma arranged independently of vessels, appearing as several white lines within growth ring, and running in a direction parallel to the growth ring (cross section). Rays exclusively uniseriate and variable in height (tangential section).

Item B - Acer saccharum. Maple

Growth rings distinct. Sapwood white with a reddish tinge. Heartwood light redding brown. No characteristic odor or taste. Uniform pores, apparent only with magnification, distributed evenly throughout the growth ring (cross section). Parenchyma not visible without magnification. Rays of two distinct widths. Rays unstoried and essentially homogeneous, 1 to 8 seriate (tangential section). Rays unicellular, composed entirely of procumbent or upright cells (radial section). Vessels 70-90 microns in diameter, numbering 40-80 per square mm. Spiral thickening apparent (radial or tangential section, pulp). Perforation plates simple (radial section, pulp). Alternate intervessel pits orbicular to hexagonal, 6-10 microns in diameter (tangential section, pulp).

Item C - Pinus monticola. Pine

Sapwood nearly white to pale yellowish white. Heartwood cream colored to light brown. Slight resinous, non-characteristic odor. No characteristic taste. Growth rings distinct. Parenchyma not visible with unaided eye. Rays very fine, not ordinarily visible with unaided eye. Normal longitudinal resin canals present. Intercellular spaces scattered throughout growth rings (cross section). Thin-walled resin canal epithelium. Cells immediately surrounding resin canal are thin-walled and frequently badly torn in sectioning (cross section, tangential section). Average diameter of longitudinal resin canal about 135-150 microns, measured in direction parallel to growth rings, and including epithelium (cross section). Ray tracheids regularly present. Cells often confined to margins of the rays and may be recognized by their small bordered pits (radial section). Ray parenchyma end walls smooth (radial section, pulp). Fenestriform cross-field pits. 1 to 2 rectangular window-like pits per field (radial section, pulp).

The wood samples were small portions of trees rigorously identified as to genus and species before they were felled. The specimens were intended initially for use as standards in a wood identification course at the University of California, Berkeley. The identification of the wood as to species was confirmed by the faculty of the School of Forestry, at the Berkeley campus, as gross specimens and by microscopic examination of sections and of mascerated fibers.

The larger pieces of wood, measuring approximately 6" x 4" x 5/16", were split into small pieces and delivered to the Forensic Sciences Foundation. The three species were split and packaged sequentially to avoid possible confusion of the samples. If this experiment were attempted in the future, the approach used in this test sample would appear to be adequate and satisfactory.

Table 80

Responses to Question 2 for Item A

Question 2: Please indicate species for Item A

Response	Number of Labs Giving Response	Percentage of Labs Giving Response
Softwood	7	10.9
Fir	16	25.0
Pine	8	12.5
Cedar	2	3.1
Spruce	2	3.1
Redwood	1	1.6
Hemlock	1	1.6
Chaemaecyeris	1	1.6
Not determined	26	40.6

Table 81

Responses to Question 2 for Item B

Question 2: Please indicate species for Item B

Response	Number of Labs Giving Response	Percentage of Labs Giving Response
Hardwood	8	12.5
Maple	20	31.3
Beech	2	3.1
Lithiocarpus Tanbark Oak	1	1.6
Birch	1	1.6
Basswood	1	1.6
Walnut	1	1.6
Mahogany	1	1.6
Oak	1	1.6
Not determined	28	43.8

Table 82

Responses to Question 2 for Item C

Question 2: Please indicate species for Item C

Response	Number of Labs Giving Response	Percentage of Labs Giving Response
Softwood	7	10.9
Pine	23	35.9
Cedar	2	3.1
Fir	1	1.6
Redwood	1	1.6
Not determined	30	46.9

Table 83

Frequency of Reported Methods

Method	Number of Labs Reporting Use of Method	Percentage of Labs Reporting Use of Method (Total = 64)
Compound microscope	54	84.4
Simple magnifier	37	57.8
Stereobinocular microscope	4	6.3
GC pyrolysis	3	4.7
Polarized microscopy	2	3.1
Reference material	1	1.6
Stereo zoom scope	1	1.6
Specific gravity	1	1.6
Phase microscopy	1	1.6
Macroscopic exam	1	1.6

PROFICIENCY TESTING

LAB CODE ____________

FIGURE 26

QUESTIONED DOCUMENT EXAMINATION

☐ CHECK HERE AND RETURN IF YOU DO NOT PERFORM QUESTIONED DOCUMENT EXAMINATION.

DATE RECEIVED IN LAB__________

DATE PROCESSED IN LAB________

DATA SHEET
PROFICIENCY TESTING PROGRAM

TEST #20
QUESTIONED DOCUMENT EXAMINATION

TRANSMITTAL LETTER BY EVIDENCE SUBMITTER

The victim in this case has had several arguments with fellow workers. It is suspected that one of these workers sent the enclosed threatening letter and envelope.

Samples are enclosed:

- handwriting of four fellow employees
- typewriting from three typewriters used where all those involved worked

You are asked to determine which (if any) of the suspects prepared the handwriting on the threatening letter as well as which of the typewriters (if any) had been used to prepare the typewriting on the letter and envelope.

NOTE: All materials have been handled by several people. It is not necessary to examine documents for fingerprints or palmprints. In addition, please disregard the fact that the questioned letter, "Q", has not been folded or rolled.

ENCLOSURES: Questioned envelope
Questioned letter, marked "Q"
Handwriting specimens: 4 standard specimens from each of 4 suspects, marked by B, C, D and E.
Typewriting standards, marked 1, 2 and 3 prepared on:

1. Royal Upright HHP #5866314
2. IBM Selectric #9370467
3. IBM Selectric D.C. #122596, SN#26-214-1243

(Over)

1. Did any of the suspects execute the handwriting on the questioned letter?

☐ Yes	If "yes", which one?	☐ B
☐ No		☐ C
☐ Inconclusive		☐ D
		☐ E

2. Was any of the three typewriters used to prepare the envelope?

☐ Yes	If "yes", which one?	☐ 1
☐ No		☐ 2
☐ Inconclusive		☐ 3

3. Was any of the three typewriters used to prepare the questioned letter?

☐ Yes	If "yes", which one?	☐ 1
☐ No		☐ 2
☐ Inconclusive		☐ 3

4. Could any of the three typewriters be excluded as having been used to prepare the questioned letter?

☐ Yes	If "yes", indicate which one(s)	☐ 1
☐ No		☐ 2
☐ Inconclusive		☐ 3

5. Please explain any factors or observations which influenced the development of your opinion. (Attach additional sheets if necessary.)

6. Does your laboratory maintain a reference file of typewriting standards? ☐ Yes ☐ No

Please describe briefly: ______________________________

____

____

7. Additional Comments: (Attach additional sheets.)

The questioned document samples are characterized by the manufacturer as follows:

Handwriting

Ideal Answer: Suspect B wrote the questioned writing on the threatening letter (thus eliminating Suspects C,D,E).

Conservative Answer: Variations in suspect's writing precluded definite opinion but some similarities noted. Differences noted with writing of Suspects C,D,E.

All samples were prepared by having Messrs. B, C, D and E write the specimens from a typewritten message. All four people who executed handwriting in this specimen were selected from the manufacturer's laboratory staff. One individual (writer E) had a reasonably similar handwriting to that of the Q writer (writer B). Writer E was asked to modify his "Y" and "I" to conform to those executed by writer B. This action to make the test slightly more difficult was taken because critiques of the preliminary specimens indicated the test was too simple.

Typewriting

Ideal Answer: Typewriter used to type Std. #1 was used to type the envelope. The typing element or ball, used to type Std. #3 was used to type the Q letter possibly using the same typewriter. Q could not have been typed on the same typewriter used to prepare typewriter Std. #2.

The machine which typed typewriter Std. #2 could not have typed the Q letter because it cannot type 12 spaces to the inch. The typing element characters do not bear the relatively large number of individual, characterizing letterface defects present in the Q letter.

The Courier 12 ball used in Q and typing Std. #3 has the following defects:

lower case "m" has center serif missing,
lower case "g" has defect at approximately 1 o'clock,
lower case "y" has lower left serif shortened,
lower case "r" has lower right serif shortened,
lower case "t" has the crossing bar shortened from the right.

Handwriting and typewriting are the most commonly encountered types of questioned documents evidence. The questioned documents specimens were oriented towards stimulating the largest possible number of laboratories, which were doing any document work at all, to participate. Thus, the test was very simple in design and easy to answer correctly. This thinking and execution were proven to be quite satisfactory with a large number of laboratories responding. The original specimens were modified only very slightly because of the previewers' feedback that the sample was far too easy to analyze.

LAB CODE ____________

FIGURE 27
FIREARMS EXAMINATION

☐ CHECK HERE (AND RETURN) IF YOU DO NOT PERFORM FIREARMS EXAMINATION

DATE RECEIVED IN LABORATORY____________

DATE PROCESSED IN LABORATORY____________

DATA SHEET

PROFICIENCY TESTING PROGRAM
TEST #21

FIREARMS EXAMINATION

Examine according to your normal laboratory procedures and complete portion(s) below which complies with your laboratory policy.

All bullets are marked with a letter on the base; the wrapping for each bullet is also marked with the same letter as appears on the base of the bullet.

1. BULLET COMPARISONS

   a. Which, if any, of the three projectiles were fired from the same gun?

   ☐ None

   ☐ Projectiles fired from same gun
   (List letters)

   ____

   ____

   ____

   ☐ Inconclusive
   Explanation of inconclusive answer:

(Over)

2. ADDITIONAL COMMENTS:

DATA SHEETS MUST BE POSTMARKED BY MARCH 4, 1977

The firearms sample can be characterized according to the sample manufacturer as follows:

> "The copper-jacketed bullet (marked on the base with any one of the following letters assigned on the basis of random selection: A, B, C, D, E, F, G, H, J, K, L, O, P, Q, R, S, T, U, V, Y) was fired from a Wilkinson .25 Auto pistol, Diane Model, Serial Number 00386. A total of 127 rounds were fired in seven groups.
>
> The copper-jacketed bullets (marked on the base with any one of the following letters assigned on the basis of random selection: I, M, N, X, Z) were fired from a second Wilkinson .25 Auto pistol, Diane Model, Serial Number 00113. A total of 263 rounds were fired in six groups.
>
> The two barrels used were rifled within 10 of each other."

This test was designed to measure the proficiency of laboratories in the comparison of individual characteristics of fired bullets with less than highly individual marking.

The bullets were assembled into test samples that were made up from within the same firing batch. Eighteen to forty-four bullets fired consecutively was a batch. In order to minimize the possible changes that might have occurred in the barrels over a period of time, no bullets from the first batch of firings were packaged with any bullets from the last batch.

CHAPTER IV

FINDINGS

INTRODUCTION

In this volume, the project has been described in the context of the parameters within which it was conducted throughout its three year duration. It is worthwhile to review the more significant of those parameters before citing and discussing the findings drawn from observations presented in previous chapters.

The overriding project parameter, the one that did more to dictate the conditions under which most scheduled activities of the project were undertaken, was cited in the opening paragraph of Part IV of the Grant Proposal: "**a research study of how to prepare and distribute specific samples; how to analyze laboratory results; and how to report those results in a meaningful manner."[1] As such, the project could not also be conducted like an established, proven, sustaining proficiency testing program--a point overlooked by some laboratories and observers. The fact that the activities of the project produced accurate and meaningful data by which to make a limited assessment of general laboratory capabilities is a tribute to the contribution made by the individuals and laboratories who participated in the research effort.

The second parameter of significance to the conduct of project activities was the constant uncertainty of participation by the approximately 240 laboratories in the United States, its possessions and Canada, and the constant requirement for sensitivity to laboratory reaction to various activities, while, at the same time conducting an honest research program. Because of the autonomy exercised by the cities, counties and states for whom most of the laboratories work, participation was openly declared to be "voluntary". Non-participation could result from any number of conditions among which were: a simple disbelief in proficiency testing; concern that confidentiality of data would not be maintained; and, not least, the concern that their laboratory would not do well in the tests. Note that such reasons for non-participation as a heavy laboratory workload or non-performance of particular types of tests are not included in the conditions cited above because workload and limited service are uncompromising facts of life. The others are opinions.

---

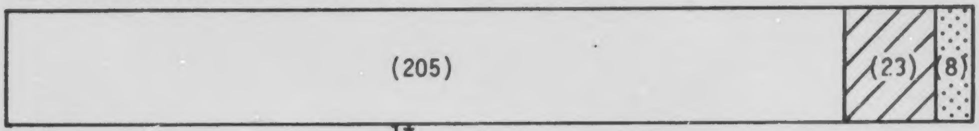
[1] First Paragraph, Part IV, Program Narrative, "Project Plan Summary," Application for Federal Assistance, January 27, 1976

In summary, the manner in which various activities were accomplished was significantly influenced by the fact that this was a research project...not an on-going proficiency testing program...and that participation by the laboratories was, of necessity, voluntary. In that context, the findings which follow are divided into two broad categories: those that apply to the research in how to conduct a criminalistics proficiency testing program and those applicable to the results obtained from actual tests of proficiency.

Table 84

RESPONSE RATES

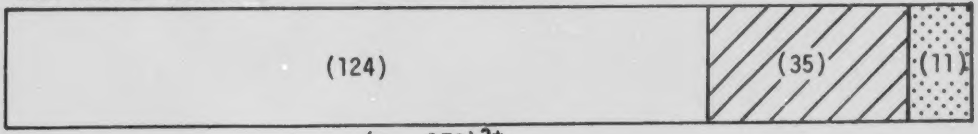
TEST SAMPLE NUMBER 1: CONTROLLED SUBSTANCE



(n[1*] = 236)

Participation Rate[2*] = 90%

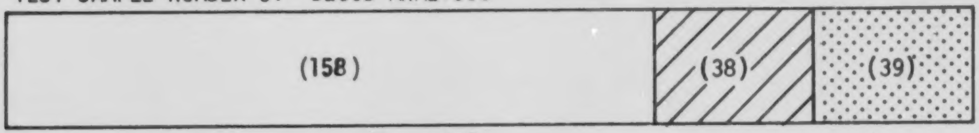
TEST SAMPLE NUMBER 2: FIREARMS EVIDENCE



(n = 170)[3*]

Participation Rate = 78%

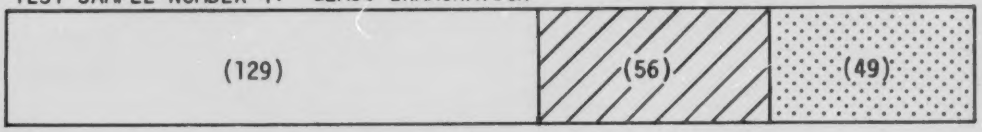
TEST SAMPLE NUMBER 3: BLOOD ANALYSIS



(n = 235)

Participation Rate = 81%

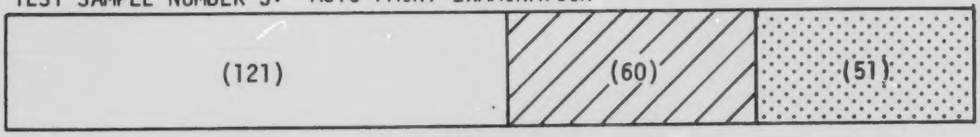
TEST SAMPLE NUMBER 4: GLASS EXAMINATION



(n = 234)

Participation Rate = 70%

TEST SAMPLE NUMBER 5: AUTO PAINT EXAMINATION



(n = 232)

Participation Rate = 67%

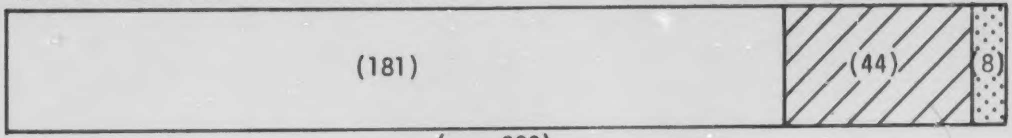
☐ = Response With Data

▨ = No Response

░ = Do Not Perform This Type of Analysis

* - See Page 195.

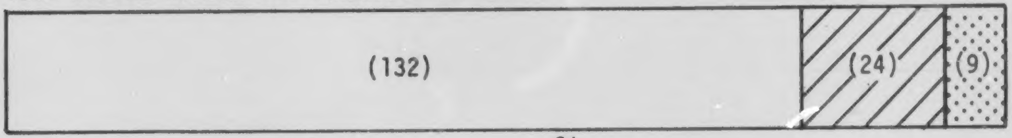
TEST SAMPLE NUMBER 6: DRUG ANALYSIS



(n = 233)

Participation Rate = 80%

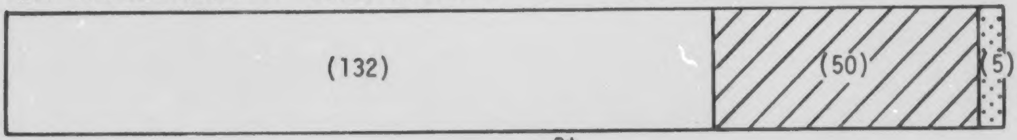
TEST SAMPLE NUMBER 7: FIREARMS EVIDENCE



(n = 165)^{3*}

Participation Rate = 85%

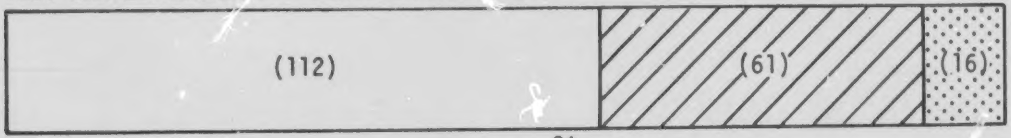
TEST SAMPLE NUMBER 8: BLOOD ANALYSIS



(n = 187)^{3*}

Participation Rate = 73%

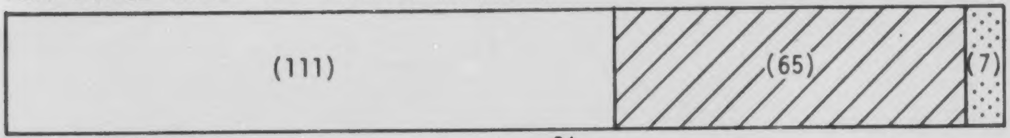
TEST SAMPLE NUMBER 9: GLASS EXAMINATION



(n = 189)^{3*}

Participation Rate = 65%

TEST SAMPLE NUMBER 10: PAINT EXAMINATION



(n = 183)^{3*}

Participation Rate = 63%

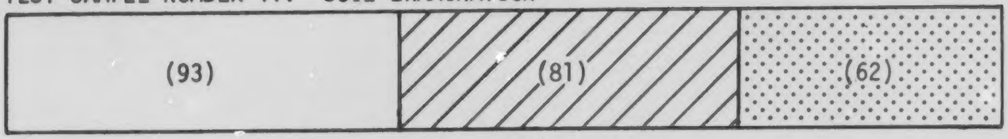
☐ = Response With Data

▨ = No Response

░ = Do Not Perform This Type of Analysis

* - See Page 195.

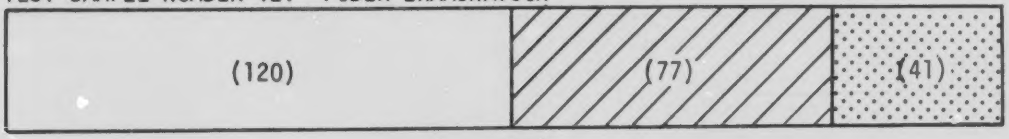
TEST SAMPLE NUMBER 11: SOIL EXAMINATION



(n = 236)

Participation Rate = 53%

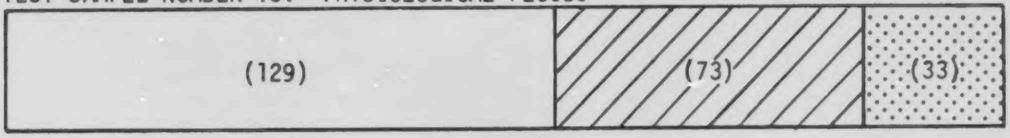
TEST SAMPLE NUMBER 12: FIBER EXAMINATION



(n = 238)

Participation Rate = 61%

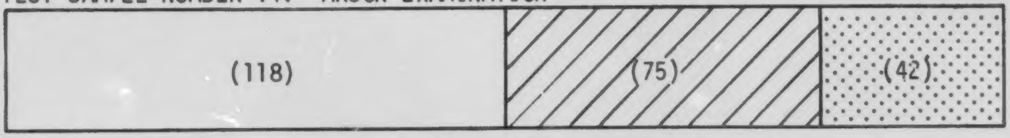
TEST SAMPLE NUMBER 13: PHYSIOLOGICAL FLUIDS



(n = 235)

Participation Rate = 64%

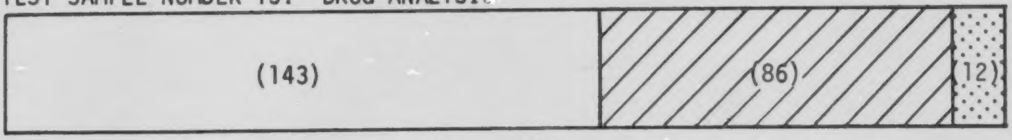
TEST SAMPLE NUMBER 14: ARSON EXAMINATION



(n = 241)

Participation Rate = 61%

TEST SAMPLE NUMBER 15: DRUG ANALYSIS



(n = 241)

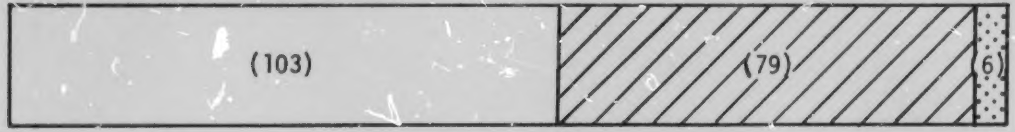
Participation Rate = 62%

☐ = Response With Data

▨ = No Response

⬚ = Do Not Perform This Type of Analysis

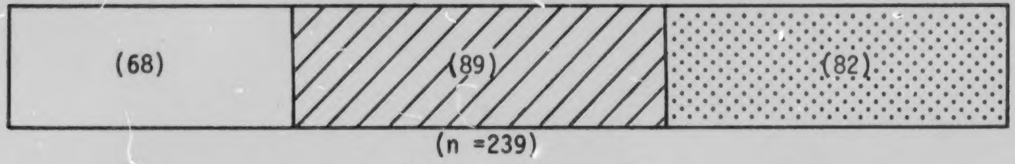
TEST SAMPLE NUMBER 16: PAINT EXAMINATION



(n = 188)^{3*}

Participation Rate = 57%

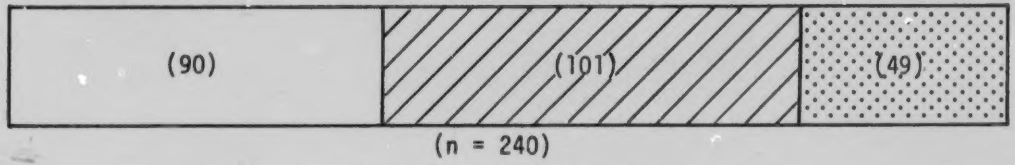
TEST SAMPLE NUMBER 17: METAL EXAMINATION



(n =239)

Participation Rate = 43%

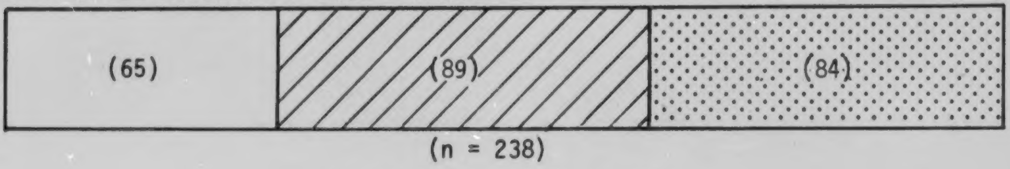
TEST SAMPLE NUMBER 18: HAIR EXAMINATION



(n = 240)

Participation Rate = 47%

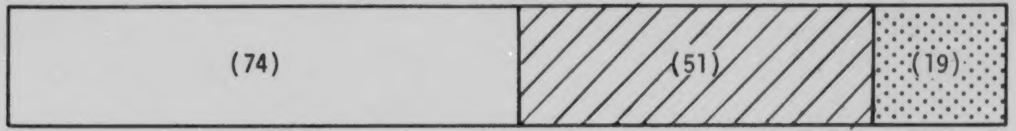
TEST SAMPLE NUMBER 19: WOOD EXAMINATION



(n = 238)

Participation Rate = 42%

TEST SAMPLE NUMBER 20: QUESTIONED DOCUMENT EXAMINATION



(n = 144)^{3*}

Participation Rate = 59%

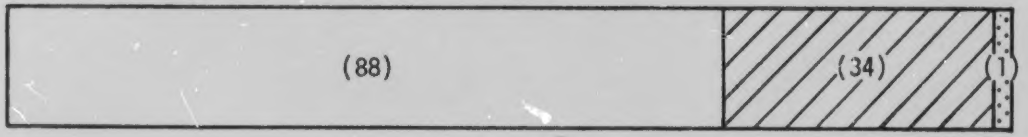
☐ = Response With Data

▨ = No Response

⬚ = Do Not Perform This Type of Analysis

* - See Page 195

TEST SAMPLE NUMBER 21: FIREARMS EVIDENCE



(n = 123)[3]

Participation Rate = 72%

□ = Response With Data

▨ = No Response

░ = Do Not Perform This Type of Analysis

---

[1] - "n" represents the total number of samples sent.

[2] - See page 40 for definition.

[3] - The basic roster of laboratories was reduced by removing those laboratories who previously indicated that they do not perform such examinations.

TEST #1 - CONTROLLED SUBSTANCE

The controlled substance, Sodium Pentobarbital, sent out as Test Sample #1 was correctly identified by 189 of the 205 laboratories reporting. This represents 92.2% of the laboratories participating. A response of "barbiturate" or "a barbituric acid derivative" was considered a correct response, since a number of jurisdictions are not required by statutory considerations to carry the analysis beyond this point.

Sixteen laboratories reported incorrect or imperfect results. Of these, one laboratory found no drug material, one found Librium, and fourteen identified the material as some other barbiturate.

The Project Advisory Committee is in accord with the following general comments in regard to this Sample:

- The laboratories reporting "no drug" and "Librium" apparently used methodology which was not sufficient to the task. Although TLC and UV were used by many laboratories correctly reporting pentobarbital, it is apparent that much more emphasis was placed on GC, IR, and microcrystalline tests.

- Of the 14 laboratories reporting a barbiturate other than pentobarbital, TLC was used in seven instances, GC in six instances, IR in ten instances, and microcrystalline tests in three instances. The Project Advisory Committee can conclude that either one or both of the following may have occurred:

    - Δ Mislabelled or contaminated primary standard,

    - Δ Misinterpretation of the test results by the operator resulting from carelessness or lack of experience. Examples of this area would include the misinterpretation of IR spectra, the failure to properly recognize and interpret crystal forms, and other types of operator error.

TEST #2 - FIREARMS EXAMINATION

Analysis of the responses to Test Sample #2, Firearms, reveals that the test actually addressed two separate areas:

1) The ability of the laboratory to examine and measure the evidence, and
2) The extent of the data maintained by the laboratory on class characteristics of firearms.

The Project Advisory Committee is in accord with the following general comments in regard to this Sample.

- Reporting that projectile Item #1 could have been fired in any .38 caliber weapon, or that projectile Item #3 could have been fired in any .380 automatic pistol, would seem to be a questionable practice. The Project Advisory Committee recognizes the responsibility of the laboratory not to exclude possible weapons. However, the class characteristics of the evidence do, in fact, exclude certain weapons. Failure to indicate either possible weapons, or, alternatively, improbable weapons, could well result in a situation where the investigating officers needlessly channel investigative effort into following improbable weapons, squandering time that could be used more profitably elsewhere.

  This statement, however, should not in any way be construed as in opposition to the practice of many laboratories of appending a general statement to the effect that the list of possible weapons may not be inclusive.

- The Committee recognizes that the class characteristics of weapons do not, in many instances, permit an unequivocal determination of manufacturer and/or model to be made. However, the weapon involved in Items #1 and #2 was a Smith and Wesson, and the weapon involved in Items #3 and #4 was a Beretta. The Project Advisory Committee is in accord that correct responses to the questions regarding possible weapons should have specifically mentioned Smith and Wesson and Beretta in some form.

  In connection with Item #1, 8% of the responses failed to mention Smith and Wesson. In connection with Item #3, 26% of the responses failed to report Beretta. In connection with Item #4, 43% of the responses failed to report Beretta.

- It is apparent from the responses to this test sample that some laboratories have access to data on class characteristics that were not available or not invoked by other laboratories. These data are fragmented to such an extent that it is apparently not being used uniformly, and possibly are not being used efficiently. The Project Advisory Committee urges LEAA/NILECJ or other groups to consider the compilation and publication of firearms class characteristics under one cover.

TEST #3 - BLOOD ANALYSIS

Type B blood was reported correctly by 152 of the 158 laboratories participating.

Five laboratories reported results at variance with type B blood. Two reported type AB, two reported type O, and one lab failed to find any indication of either blood group antigen or blood group antibody.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

- One of the laboratories reporting type O conducted only a test for the antibody. The Project Advisory Committee believes that the Lattes test or other test for blood group antibodies is, by itself, insufficient for purposes of forensic bloodstain analysis.

- In the remaining four instances, the absorption elution technique was attempted. Errors here may have arisen from inexperience or carelessness on the part of the examiner.

Type MN blood was reported correctly by 15 of 25 laboratories attempting this system. This represents 60% of the attempts.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

- All of the laboratories attempting the MN typing used the absorption elution method. Each of the 9 laboratories reporting type M had also used the absorption elution technique in the ABO typing, and had correctly typed the stain as type B. The Project Advisory Committee concludes that the errors may well be attributable to considerations other than technique. MN antisera is widely held to be treacherous, and the erroneous results may possibly be attributed to poor antisera.

  The Project Advisory Committee urges LEAA/NILECJ to investigate the possibility of funding research projects to develop more reliable antisera for the MN system, as well as other antisera specifically for forensic purposes.

- The incorrect responses relative to the Rh typing illustrates a significant point; the frequency of occurrence of certain Rh factors in such that a single error may exert a profound influence in the interpretation of typing data.

- Of the 158 laboratories responding to this Test Sample, only 20 attempted the PGM type, only 15 attempted the EAP type, only 2 attempted to perform a Haptoglobin determination, 3 attempted the AK type, and 10 attempted the Hemoglobin type.

The Project Advisory Committee recognizes that in this instance, the blood samples were distinguishable by ABO typing alone. However, the Committee believes that the Crime Laboratories in the nation cannot rely upon ABO grouping alone as a general rule. Laboratories doing so are ignoring the very powerful discriminating abilities of the isoenzyme and serum protein techniques. There is a rapidly growing awareness of the value of these techniques in the criminal justice system. The skill inventories required to conduct these examinations should be within the reach of virtually any laboratory conducting forensic blood testing. The capital outlay for equipment is modest, and the techniques are neither controversial nor untested. The Project Advisory Committee considers the number of laboratories conducting these examinations to be deficient, and urges laboratories not now conducting these examinations to systematically build a capability in this area.

TEST #4 - GLASS ANALYSIS

Test Sample #4 was reported correctly by 123 of the 129 laboratories responding. This represents 95.3% of the laboratories participating.

Six laboratories responded that the glass samples could have shared a common origin, or that their tests were inconclusive.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

- The Committee does not condemn in any way the reporting of inconclusive results, when appropriate. Situations in which such a response would be appropriate might include an inadequate amount of evidence, a contaminated sample, or where the sample possesses few inherent charazterizing features. This is not the case in this test sample. The state of the art in criminalistics is certainly advanced to the point that these samples of glass should be easily distinguished by techniques available to any laboratory attempting to conduct glass examinations. The Project Advisory Committee believes that an inconclusive report in this sample is not supportable.

  The two inconclusive responses emerged out of different situations. In one case, the methodology employed was insufficient; in the other case exhaustive data were produced to demonstrate the dissimilarities between the two samples, but the operator apparently failed to interpret the data properly.

- Laboratories should exercise great caution in relying upon a single technique for the characterization of evidence.

- Of the four laboratories reporting that the samples could have shared a common origin, all incorrectly performed or interpreted refractive index determinations. This would appear to be an area deserving some attention.

TEST #5 - AUTOMOBILE PAINT EXAMINATION

Test Sample #5 was reported correctly by 97 of the 121 laboratories responding. This represents 80% of the laboratories participating.

Twenty-four laboratories reported results at variance with the manufacturers' statement and the results of the referee laboratories. Twenty-two laboratories reported that Item A could have had a common origin with both Items B and C, one laboratory reported inconclusive results.

The Project Advisory Committee is in accord with the following general comments in regard to this sample.

- The Committee does not condemn in any way the reporting of inconclusive results, when appropriate. Situations in which such a response would be appropriate might include an inadequate amount of evidence, a contaminated sample, or where the sample possesses few inherent characterizing features. This is not the case in this test sample. The state of the art in criminalistics is certainly advanced to the point that these samples of paint should be easily distinguished by techniques available to any laboratory attempting to conduct paint examinations. The Project Advisory Committee believes that an inconclusive report in this sample is not supportable.

- The laboratory reporting that neither Item B or C could have shared a common origin with Item A relied upon a spectrographic analysis but provided no details. The Project Advisory Committee believes that a spectrographic analysis alone is not sufficient to characterize paint for forensic purposes.

- Many of the remaining twenty-two laboratories reporting that all three paints could have shared a common origin failed to make proper use of solubility tests; solubility tests possess the inherent ability to distinguish Item C from Item A and Item B. It should be noted, however, that a number of the laboratories that reported that all three paints were indistinguishable did make use of solubility tests. The Project Advisory Committee concludes that these tests were either interpreted incorrectly, or that inappropriate solvents were employed. No test is infallible, and solubility tests, like all others, must be properly conducted and properly interpreted.

- Several laboratories reported similar or identical results for all paints when subjected to pyrolysis-gas chromatography. The error here may be due to either or both of the following:

  - Δ Inexperience or carelessness on the part of the examiner, or,

  - Δ Improper operating conditions for this type of instrumental approach.

- A number of other laboratories reporting that all three samples were indistinguishable provided so little detail with respect to methodology that the Project Advisory Committee is unable to draw any meaningful conclusions regarding weaknesses or possible sources of error.

TEST #6 - DRUG ANALYSIS

A mixture of heroin, cocaine, procaine, and lactose was sent out as Test Sample #6. The mixture was made up with the levels of heroin, cocaine, and procaine set at 3% each, the remainder being lactose.

Heroin was correctly reported by 178 of the 181 laboratories participating, representing 98.3% of the laboratories involved in this study. Cocaine was identified by 126 of the laboratories, or 69.6% of those participating. Procaine was correctly identified by 130 laboratories, or 71.8% of the laboratories participating. It should be noted that in some instances statutory considerations or laboratory or agency policy require that only one controlled material need be identified.

Eight laboratories reported traces of monoacetylmorphine in addition to heroin, many having used sensitive techniques such as GC/MS in performing these analyses. Although the supplier's statement makes no mention of monoacetylmorphine, it is reasonable to expect a trace of this material due to incomplete acetylation hydrolysis of the heroin. Three laboratories, also utilizing GC/MS, found traces of acetylcodeine. Again, it is not unreasonable to encounter a trace quantity of acetylcodeine as a constituent normally found with heroin, and, although the supplier's statement makes no mention of acetylcodeine, the Project Advisory Committee does not consider the reporting of either acetylcodeine or monoacetylmorphine to be an incorrect response.

One laboratory failed to identify any controlled substance in the test sample, one laboratory identified quinine, three laboratories identified starch, one laboratory found tentative indications of methapyrilene, one laboratory found morphine but no monoacetylmorphine, and two laboratories identified monoacetylmorphine as the major component with heroin present in lesser or trace concentrations.

The Project Advisory Committee is in accord with the following general comments in regard to these responses:

- The laboratory reporting no controlled drug material used only an unspecified color reaction and a microcrystal test. The limited methodology applied was insufficient for the purpose of detection and identification of drug or narcotic materials.

- Three laboratories reported starch, although from the data sheets returned it is unclear what methodology was used in the identifications. The Project Advisory Committee concludes that the cause of these errors most likely rests in carelessness or lack of experience on the part of the examiner.

- One laboratory reported a trace of morphine, but specifically eliminated the presence of monoacetylmorphine. On the basis of what is known of the hydrolysis of heroin through monoacetylmorphine to morphine, the Project Advisory Committee views these results with skepticism.

The laboratory reporting quinine used UV, IR, Spot Tests, Microcrystal Tests, and Melting Point Tests. The Project Advisory Committee can conclude that either one or both of the following may have occurred:

- Mislabelled or contaminated primary standard.
- Misinterpretation of the Test results by the operator resulting from carelessness or lack of experience. Examples of this type would include the misinterpretation of IR spectra, the failure to properly recognize and interpret crystal forms, and other types of operator error.

Two laboratories reported traces of heroin and larger concentrations of monoacetylmorphine. The Project Advisory Committee regards these as two instances of misidentification. One of the laboratories reported using Color Tests, Microcrystal Tests, UV Spectrophotometry, and TLC. The other laboratory reported using Color Tests, Melting Points, GC, and TLC in three solvent systems. The Project Advisory Committee concludes that one or more errors such as those previously cited may have occurred.

TEST #7 - FIREARMS EXAMINATION

Each laboratory received three projectiles and two cartridge cases, in accord with a specific scenario (See Appendix, Data Sheet #7 and Quick Report #7). The scenario required the participating laboratory to compare the three projectiles to determine if they had been fired through the same weapon, and to compare the two cartridge cases to determine if they had been fired in the same weapon.

The projectiles marked A, B, C, D, E, F, G, H, J, K, L, O, P, Q, R, S, T, U, V, or Y, and the cartridge cases marked 5, 7, or 8, were fired through one weapon, a Colt .32 Auto pistol, Serial #214325. The projectiles marked I, M, N, X, or Z, and the cartridge cases marked 2, 3, or 4, were fired in another weapon, a Colt .32 Auto pistol, Serial #521524.

One laboratory reported inconclusive results in the portion of the exercise involving projectiles, and 26 laboratories reported inconclusive results in the portion dealing with the comparison of cartridge cases. Five laboratories reported results in the section dealing with projectiles which are at variance with the supplier's statement, and four laboratories reported results in the section dealing with cartridge case comparisons which are at variance with the supplier's statement.

The Project Advisory Committee is in accord with the following general statements in regard to these responses:

> Either a "no" or an "inconclusive" response to question 1b (dealing with the cartridge cases) is acceptable. The Project Advisory Committee recognizes that although a "no" response is more correct in an absolute sense, the general area of firearms identification is one that calls for considerable caution. Ultimately, unless other issues are involved, it remains for the examiner to determine for himself the modicum of proof necessary to arrive at a definitive opinion. At the same time, however, the firearms examiner should not divest himself of the responsibility to refine his attitudes in light of additional experience so that a more definitive opinion can be rendered when the circumstances warrant.
>
> Five laboratories misidentified a projectile, reporting that one of the projectiles actually fired through the Colt .32 Auto pistol, Serial #521524, had been fired through the other weapon, the Colt .32 Auto pistol, Serial #214325. Five laboratories (including three of the laboratories who misidentified a projectile) misidentified a cartridge case, reporting that one of the cartridge cases actually fired through the Colt .32 Auto pistol, Serial #521524, had been fired in the other weapon, the Colt .32 Auto

pistol, Serial #214325. Five laboratories represent 3.8% of all the laboratories participating in this study. The Project Advisory Committee considers these errors to be particularly grave in nature, and urges the laboratories involved to immediately undertake such measures as necessary to correct their deficiencies. A criminal prosecution may hinge entirely, or virtually so, upon firearms evidence and the testimony of the firearms identification expert, and the potential exists for a truly severe miscarriage of justice. Responsibility for errors such as those under discussion rests squarely with the examiner and those responsible for his supervision. The Project Advisory Committee concludes that these errors may have resulted from one or more of the following:

- Carelessness on the part of the examiner.
- A lack of experience or training on the part of the examiner.
- Inadequate supervision by a qualified firearms identification expert.

TEST #8 - BLOOD ANALYSIS

Two samples, each consisting of several drops of blood on a swatch of cloth, were sent to participating laboratories. Reports were received from 131 laboratories. The following four questions were asked (See Appendix, Data Sheet #8 and Quick Report #8):

Question 1: Have the stains been confirmed as blood?

Question 2: Have the stains been confirmed as human blood?

Question 3: Could Item A and Item B (the two stains) have originated from the same source?

Question 4: What information did you develop to arrive at your conclusion in Question #3?

The responses to these questions have been tabulated in considerable detail in the document entitled "Laboratory Proficiency Testing Program Report No. 8 - BLOOD". The Project Advisory Committee wishes to address several broad areas, and the reader is advised to refer to Report No. 8 for details concerning specific areas.

Fifty-two of the 132 laboratories returning data reported that the two bloodstains could not have shared a common source, however, fourteen of these laboratories made errors in typing in various systems. Therefore, thirty-eight laboratories responded correctly as to common origin and correctly typed the samples. This represents 28.8% of the laboratories responding. Fifty laboratories incorrectly reported that the two stains could have shared a common origin and twenty-six reported inconclusive results. Four laboratories performed some aspect of typing the samples but did not respond to the question regarding common origin. Two laboratories reported incorrect results for the ABO system. This represents 1.6% of the 123 laboratories reporting this system. Six laboratories, or 20% of the 30 laboratories using this system, reported incorrect results for the MN system. Five of the 20 laboratories reporting results for the Rh system reported incorrect results. This represents 25% of the laboratories reporting the Rh system. Two laboratories, or 6.1% of the 33 laboratories attempting the PGM system reported incorrect results. One laboratory of the 8 laboratories reporting Esterase D results reported an incorrect type. One laboratory of the 7 attempting the AK system reported incorrect results, and 1 of the 15 labs reporting the Hemoglobin type reported an incorrect type.

The Project Advisory Committee is in accord with the following general comments in regard to these results:

Fifty laboratories incorrectly reported that two stains could have shared a common origin, and 26 laboratories reported inconclusive results. In the overwhelming majority of these cases these opinions were based on minimal data, in most cases based only on the

ABO type. The Project Advisory Committee takes issue with the practice of conducting only an ABO typing and reporting that two stains could have shared a common origin, and is only slightly more sympathetic with the practice of reporting inconclusive results after conducting only ABO typing. The Project Advisory Committee is on record previously on this point, but wishes to reiterate its opinion that the Crime Laboratories in the nation cannot rely upon ABO grouping alone as a general rule. Laboratories doing so are ignoring the very powerful discriminating abilities of the isoenzyme and serum protein techniques. With proper education and training these examinations should be within the reach of virtually any laboratory conducting forensic blood testing. The capital outlay for equipment is modest, and the techniques are based on sound scientific principles. The Project Advisory Committee considers the number of laboratories conducting the more recently developed blood protein and isoenzyme group examinations to be insufficient, and urges laboratories not now conducting these examinations to systematically build a capability in this area.

One of the laboratories reporting an incorrect response for the ABO type relied upon the Lattes slide method alone. The Project Advisory Committee wishes to reiterate its previous comments, that the Lattes test or other test for blood group antibodies is, by itself, insufficient for purposes of forensic blood group analysis.

The error rate with the Rh system reflects, in part, the multiplicity of factors in this system. A number of laboratories reported all five factors, correctly reporting all but one of the factors. Nevertheless, the error rates encountered in the Rh system, points out the need for reliable, avid antisera, painstaking attention to technique, proper training on the part of the examiner, and proper supervision. Laboratories reporting incorrect responses for these systems, as well as in the isoenzyme and serum protein types, should undertake an assessment of the reliability of their methodologies and review the interpretive aspects of their determinations.

Several laboratories correctly reported that the stains A and B could not have shared a common source, but made an error at some point in the typing procedure. Although they obtained the correct answer, they did so for the wrong reasons. The Project Advisory Committee wishes to point out that a correct answer which is only coincidental still constitutes an error.

The Project Advisory Committee has observed that in a number of instances laboratories are invoking a sequence of testing which does not provide maximum discrimination. An example of this situation would be a laboratory that attempts three systems--the ABO system, the Hemoglobin type as a second choice, and, as the third choice, the AK system. The Project Advisory Committee encourages laboratories to reflect upon the probability of discrimination when establishing the order in which the tests are to be run.

TEST #9 - GLASS ANALYSIS

Each laboratory received three items of glass marked Item A, B, and C in accord with a specific hit and run scenario. The scenario required the laboratories to compare the three glass samples and to determine if Items A and B could have had common origin with C.

All of the glass samples were prepared from a single Corning headlight lens with a supplier's reported refractive index of 1.47777. When pieces from different locations of the lens were measured, the refractive index differed by no more than 4 in the 5th decimal place.

Test Sample #9 was reported correctly by 77 of the 112 laboratories responding. This represents 68.3% of the laboratories participating.

Ten (8.9%) laboratories reported only A could have had a common origin with C, while nine (8.0%) reported that only B could have shared a common origin with C.

Nine (8.0%) laboratories reported that neither A or B could have had a common origin with C, and 4 (3.6%) reported inconclusive results for both A and B.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

At least six of the incorrect responses were the result of laboratories performing an insufficient number of tests leading to the formulation of inappropriate conclusions. Density measurements, particularly those relying on the sink-float method, were too imprecise to be used as the only method for determining the origin of multiple glass samples.

Errors in refractive index and density determinations were largely responsible for incorrect responses from approximately eighteen laboratories. Refractive index variations were likely due to errors or carelessness by the operator, and failure to employ sufficiently sensitive techniques for the control and measurement of temperature and the refractive index of the immersion liquid itself. Accuracy and precision were generally improved through the utilization of more sophisticated instruments such as the phase contrast microscope and hot stage. Their use, however, did not assure correct answers as evidenced by errors from laboratories employing such refinements.

Several laboratories reported the correct answers (A and B shared a common origin with C), but reported incorrect density or refractive index values. The measurements were sufficiently precise but lacked accuracy. Such a condition indicates that these laboratories need to examine the immersion liquids and to calibrate the refractometers being utilized.

At least twelve laboratories reported that one or more of the glass samples fluoresced under UV light, with colors ranging from orange to blue-purple. The glass should not have fluoresced when subjected to either short or long wave UV; it is likely that several operators mistook the spillover from the UV light source itself as fluorescence of the sample, or that the supporting medium contributed to a background fluorescence.

Elemental analyses were significant in leading ten laboratories to erroneously report that A, B, and C did not all share a common origin. In fact, it appeared that were it not for the employment of elemental analysis, most of these laboratories would have submitted correct responses. The Project Advisory Committee does not suggest that elemental analysis should not be employed but does observe that instrumental and/or operator error resulted in spurious results in a sizeable number of cases. This area will be elaborated upon in a subsequent section of this report.

Although these glass specimens were not truly representative of evidence recovered from hit and run cases in that the pieces had been cut, rather than broken from a single headlight lens, their shape and size should not have led laboratories to conclude that they could not have shared a common origin. It appeared that some laboratories placed too much weight on the linear dimensions of the samples contributing to a conclusion that A, B, and C did not have a common origin.

TEST #10A- PAINT EXAMINATION

Laboratories received three paint samples, Item B representing a sample removed from the door jamb of a burglarized building and Items A and C representing samples found on the clothing of two different suspects. Laboratories were asked if Items A and C could have had a common origin with B.

Item A was an acrylic based paint while Items B and C were soya alkyd based paint samples. Item C contained a substantial quantity of ZnO while Items A and B contained only trace amounts of zinc.

Given the above specifications neither A nor C could have shared a common origin with B.

Test Sample #10 was reported correctly by 54 of the 111 laboratories responding. This represents 48.9% of the laboratories participating. This sample was intended to be a test of both the organic and inorganic analysis capabilities of forensic science laboratories. That is, laboratories needed organic capabilities to differentiate Item A from Item B and inorganic analysis capabilities to differentiate Item C from Item B.

Of the laboratories reporting results, 24 were unable to discriminate Item A from Item B (those with different organic compositions), and 36 were unable to differentiate Item C from Item B (samples possessing inorganic dissimilarities). In the first category 16 laboratories reported Item A and Item B could have had a common origin, with 8 laboratories reporting inconclusive results. In the second category, 31 laboratories reported Item B and Item C could have had a common origin, with the remaining 5 laboratories citing inconclusive results. Only two laboratories incorrectly reported both A and C could have shared a common origin with B.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

The laboratories which failed to detect the organic differences in Items A and B should review their instrumentation, methodologies and operator skills in the organic analysis area. Of the 16 laboratories that reported Items A and B to share a common origin, only 2 employed Pyrolysis G-C and 14 did not. Those laboratories which utilized PGC should have been able to detect differences in the two samples.

Practically twice as many laboratories (31) reported that Items B and C could have shared a common origin and therefore failed to detect the higher level of zinc in C. Of the 31 incorrect responses, 21 failed to employ any elemental analysis techniques, while 10 did. Those not employing elemental analysis should consider doing so and those that did, but failed to detect the large quantitative difference in zinc composition between Items B and C should undertake an assessment of the validity and reliability of their instrumentation, methods of analysis and guidelines for the interpretation of results.

A single laboratory reported the use of Marquis, Mecke, and Froehde reagents in an effort to differentiate the paint samples. Such procedures have no basis for the characterization of paint and should be discontinued.

There was great variation among laboratories in the use and interpretation of chemical spot tests/solubility tests. The manufacturer of the paint samples reports that the samples could have been differentiated on the basis of non-instrumental tests alone. It seems clear from reviewing the data sheets that there exists great variability in the use and interpretation of solubility tests among the nations crime laboratories and that LEAA/NILECJ should fund efforts in compiling and disseminating information/guidelines on the use and interpretation of chemical spot tests/solubility tests.

INSTRUMENTAL ANALYSIS

The Project Advisory Committee wishes to draw attention to the fact that the results of instrumental analyses reported in connection with various test samples have varied widely, both qualitatively and quantitatively. The following two tables attempt to depict this variation, using data abstracted from Test Sample No. 9, Glass, and Test Sample No. 10A, Paint.

Table 85 illustrates the elements reported by a number of laboratories for the glass samples. The glass samples were homogeneous and were cut from a single automobile headlamp. The Project Advisory Committee recognizes that the failure of a laboratory to report a specific element does not necessarily imply that the element was in fact sought for with negative results. Nevertheless, the wide variation in the reporting of the elements present suggests to the Project Advisory Committee that those laboratories utilizing elemental analysis by whatever instrumental approach should take whatever precautions necessary to ensure that proper standards are run and that the operator possesses the requisite skill inventories to interpret the instrumental data.

Table 86 illustrates the elements reported by a number of laboratories for the three paint samples, Test Sample No. 10A. Again, the lack of consistency in the reporting of the elements present suggests to the Project Advisory Committee that elemental analysis is an area that deserves attention, and suggests that laboratories employing instrumental techniques for elemental analysis carefully review their methodology.

TABLE 85

INSTRUMENTAL ANALYSIS OF GLASS - TEST SAMPLE #9

Elements Reported	Lab A	Lab B	Lab C	Lab D	Lab E
Li	X	X			
B	X		X		X
Na	X		X		
Mg	X	X	X		
Al	X	X	X		
Si	X		X	X	X
P					X
Ca	X	X	X		
Ti			X		
Mn	X	X			
Fe	X	X	X		
Cu	X	X			
Ni			X		
Zn				X	
As	X	X		X	
Zr			X		
Pb					X

TABLE 86

INSTRUMENTAL ANALYSIS OF PAINT - TEST SAMPLE #10

Elements Reported for Paint Samples

Lab	A	B	C
A	Sb Mg Fe Ti Ca Zn Si no Al	Sb Mg Fe Ti Ca Zn Si no Al	Mg Ti Ca Al Zn Si no Fe or Sb
B	Ti Mg Si high Zn	Ti Mg Si low Zn	Ti Mg Si low Zn
C	Ti low Zn	Ti low Zn	Ti high Zn
D	Cu	Cu	Cu
E	Pb Ti Ca	Pb Ti Ca	Pb Zn
F	Sb Ti Cr Cu Al High Zn	Sb Ti Cr Cu Al Zn	Sb Ti Cr Cu Al Zn

TEST #11 - SOIL EXAMINATION

Test Sample #11 consisted of three items: Item A was a soil sample from near Fresno, California. Items B and C were duplicate samples of soil from near Patterson, California. Laboratories were asked if Items B and C could have shared a common origin with Item A. Ninety-three laboratories returned results for this exercise. Of these laboratories, 60 or 64.5%, correctly reported that neither B nor C could have shared a common origin with Item A. Twenty-five laboratories, or 28.4%, incorrectly reported that both B and C could have shared a common origin with A. Two laboratories, or 2.3% of the total, reported that Item B could have shared a common origin with Item A, but that Item C could not. Five laboratories, or 5.7% of the laboratories responding, reported inconclusive results for both B and C. One laboratory reported that Item B could not have shared a common origin with Item A, and indicated no response for Item C.

To summarize these data in terms of total responses, 56 laboratories (63.5%) reported that Item B could not have shared a common origin with Item A, and 57 laboratories (63.6%) reported that Item C could not have shared a common origin with Item A. Twenty-seven laboratories (30.7%) incorrectly stated that Item B could have shared a common origin with Item A, and 25 laboratories (28.4%) incorrectly reported that Item C could have shared a common origin with Item A.

The Project Advisory Committee is in accord with the following general comments regarding this sample:

The Project Advisory Committee notes a positive relationship between incorrect responses and the failure to perform comparative density determinations; those laboratories who did not perform a density determination were more likely to draw an erroneous conclusion in this exercise than those who did perform the density determinations. At the same time, a number of laboratories reporting incorrect results did in fact conduct a density determination and reported identical density distributions for both A and B/C. Other laboratories reported a difference between B and C when tested by density gradient, despite the fact that B and C were replicate samples taken from a homogenous whole.

From this, the Project Advisory Committee concludes that the density gradient technique is very useful for discriminating among soil samples, but in itself is not a guarantee of success in soil comparisons. The Project Advisory Committee also concludes that in those instances in which the density gradient technique was attempted but erroneous results reported, one or more of the following may have occurred:

- Carelessness or lack of experience on the part of the examiner,
- Coarseness or heterogeneity in the density gradients resulting from improper technique in their preparation.

The Project Advisory Committee notes that in a number of instances in which incorrect results were reported, instrumental analysis was performed. In some instances the ambiguous or erroneous data from the instrumental approaches (emission spectroscopy, x-ray spectroscopy) was apparently given more weight than more correct data derived from other tests. The Project Advisory Committee cautions laboratories against an unjustified faith in instrumental approaches, and wishes to point out that the proper utilization of these instrumental approaches presumes both a correct operating technique and careful interpretation of the results projected against an adequate data base. The Project Advisory Committee most emphatically is not suggesting that sophisticated instrumentation not be acquired and used, but wishes to emphasize the necessity for the proper training of personnel, the use of in-house standards and blind controls, and properly selected protocols of analysis.

TEST #12 - FIBER EXAMINATION

Test Sample #12 consisted of three items of virtually the same color: Item A was wool, Item B was acrylic (70% acrylic + 30% modacrylic) and Item C was polyester. Laboratories were asked if Item A could have shared a common origin with Item C, and if Item B could have shared a common origin with Item C.

All 120 laboratories participating in this exercise correctly reported that Item A could not have shared a common origin with Item C. Two laboratories, or 1.7% of the total, incorrectly reported that Item B could have shared a common origin with Item C.

The Project Advisory Committee is in accord with the following general comments regarding this sample:

One laboratory reporting that Items B and C could have shared a common origin used microscopic examination of the fiber and of its cross section, melting point determination, and solubility tests. On the basis of these tests, Item B was identified as acrylic and Item C was tentatively identified as polyester. The differences in solubility and cross sectional appearance were noted. The analytical results clearly do not support a determination of possible common origin, and the Project Advisory Committee concludes that a check was made in the wrong box in Question 1 of the Data Sheet.

The Project Advisory Committee wishes to point out, however, that an error in reporting may have the same consequences as an error in the analytical work, and suggests that laboratories review their procedures for ensuring that the conclusions stated in reports are in consonance with the laboratory work that has been performed.

The second laboratory reporting that Items B and C could have shared a common origin used microscopic examination, solubility tests, Pyrolysis-GC, and birefringence determination. Solubility tests and Pyrolysis-GC were reported as giving the same results on Items B and C, and both fibers were identified as being an acrylic. The Project Advisory Committee concludes that one or more of the following errors may have occured:

- Inadequate or erroneous data base relative to solubility tests and Pyrolysis-GC,
- Misinterpretation of the test results by the operator resulting from carelessness or lack of experience.

Several laboratories correctly reported that Items A and B could not have shared a common origin with Item C, but did so for incorrect reasons. One laboratory reported that Item C was a plant fiber, one laboratory identified Item C as nylon, and two laboratories tentatively identified Item C as nylon. The Project Advisory Committee wishes to point out that a correct answer which is only coincidental is still an error, and urges the laboratories who misidentified the polyester of Item C to review their methodology to eliminate the possible sources of error cited above.

TEST #13 - PHYSIOLOGICAL FLUID

Test Sample #13 consisted of two items: Item A was a saliva stain from a Type A secretor individual, and Item B was a seminal stain from a Type A secretor individual with a normal sperm count. One hundred and twenty-nine laboratories responded in this exercise. With respect to Item A (saliva stain) 48 laboratories, or 37.2% of those reporting, tentatively identified the stain as a saliva stain and 23 laboratories (17.8%) conclusively identified the stain as a saliva stain. Thirty-seven laboratories (34.1%) reported inconclusive results. Eleven laboratories (8.5%) did not answer part A. One laboratory (0.8%) tentatively identified Item A as vaginal exudate and 2 laboratories (1.5%) conclusively identified the stain as vaginal exudate. With respect to Item B (seminal stain) 109 laboratories, or 84.4% of the total number responding, conclusively identified the stain as a seminal stain. Fifteen laboratories (11.6%) tentatively identified it as a seminal stain and 3 laboratories (2.3%) reported inconclusive results.

The Project Advisory Committee is in accord with the following general comments regarding this sample:

The Project Advisory Committee recognizes that the probative value of the identification of saliva stain may be low in many instances, and that many laboratories have adopted a policy in routine cases of terminating an examination once it has been established that a stain is not a seminal stain. The Project Advisory Committee does not, therefore, consider the response "not a seminal stain" to represent an incorrect response.

In a like manner, the Project Advisory Committee does not take issue with the tentative identification of the stain as a saliva stain if it is the normal laboratory policy not to pursue a rigorous identification in situations of this sort. At the same time, the Project Advisory Committee would urge laboratories to push for a rigorous identification when it is of concern to establish that the stain is in fact a saliva stain. Among the situations that would call for a rigorous identification would include those cases in which a blood group determination is attempted.

The two laboratories that reported that Item A was conclusively a vaginal stain both failed to attempt a starch amylase test. Since the identification of a stain as a vaginal stain rests heavily on negative evidence, the Project Advisory Committee wishes to point out the necessity of attempting the appropriate tests to indicate the probable nature of the stain. In this instance, the positive starch amylase test would have suggested the probability of the stain being attributable to saliva.

Two laboratories reported inconclusive results for Item B (seminal stain). One of these laboratories failed to indicate any methods used, and the Project Advisory Committee cannot express any meaningful statement regarding the adequacy of the methodology used. In the remaining instance where an inconclusive result was reported, a microscopic examination was performed and an acid phosphatase test was conducted. No specific results were reported, but the Project Advisory Committee assumes that no intact spermatazoa were recovered.

Eighteen laboratories reported Item B as being tentatively identified as a seminal stain. Virtually all of these laboratories reported being unable to demonstrate intact spermatazoa in the stain. No positive relationship was observed between the stain used and the ability or inability to recover intact spermatazoa. In view of the fact that the overwhelming majority of laboratories were able to recover spermatazoa from the stain, the Project Advisory Committee concludes that one or more of the following may have occurred:

- Improper extraction and fixing of the stain,
- Failure to systematically examine the slides prepared from the stain,
- Or a failure to continue the search for cells after an initial lack of success.

The Project Advisory Committee urges laboratories to review their methods for the extraction of stains and the fixation of the cells to the microscope slide, and to ensure that reasonable perseverance is excercised in the search for spermatazoa.

TEST #14 - ARSON EXAMINATION

Test Sample #14 consisted of three items: Item A was approximately 8 ml of leaded gasoline, specifically Chevron Supreme (94.5 octane). Item B was a piece of 100% cotton cloth with 2 ml of the gasoline described under Item A absorbed in the cloth. Item C was another piece of cloth identical to that described under Item B, but with no gasoline. Items B and C were cut with scissors from one piece of cloth. Laboratories were asked if Items A or C could have a common origin with Item B. One hundred and eighteen laboratories responded in this exercise. Ninety laboratories, or 76.3% of the total laboratories responding, stated correctly that Item A could have shared a common origin with Item B. One hundred and one laboratories, or 85.6%, correctly reported that Item C could have shared a common origin with Item B. Twelve laboratories (10.2%) stated incorrectly that Item A could not have shared a common origin with Item B, and 4 laboratories (3.4%) incorrectly reported that Item C could not have shared a common origin with Item B.

The Project Advisory Committee is in accord with the following general comments regarding this sample:

The four laboratories that reported that Item C and Item B and the five laboratories that reported inconclusive results for this portion of the exercise failed to recognize the physical match between the cotton cloth in the two items. The Project Advisory Committee urges laboratories to take the steps necessary to ensure that one form of physical evidence is not ignored simply because it is not typical of the type of case under examination.

The twelve laboratories reporting that Item A could not have shared a common origin with Item B relied in part on gas chromatographic analysis. The Project Advisory Committee concludes that carelessness or lack of experience on the part of the operator may have lead to these erroneous conclusions.

Several laboratories reported less than correct results which appear in part to reflect an unjustified reliance on Infrared Spectrophotometry to discriminate between gasoline mixtures. The Project Advisory Committee urges that considerable caution be exercised in the interpretation of IR data on complex mixtures of hydrocarbons and petroleum distillates.

TEST #15 - DRUG ANALYSIS

A mixture of methamphetamine and ephedrine in lactose and sodium carbonate was sent out as Test Sample #15. One hundred forty-six laboratories reported results. Eighty-seven laboratories, or 59.6% of the total correctly reported both methamphetamine and ephedrine. Thirty-one laboratories, or 21.2%, reported methamphetamine only. Four laboratories, or 2.7%, reported amphetamine and seven laboratories, representing 4.8% of the total laboratories, reported no drug material present. Three laboratories responding did so late; their results are not included in Tables 88 nor are they reflected in Tables 84, 89, 90 or 91.

The Project Advisory Committee is in accord with the following general comments regarding this sample:

The Project Advisory Committee recognizes that many laboratories have a policy of pursuing an analysis only to the point where relevant statutory considerations are fulfilled, and, having identified the methamphetamine, would conclude the examination. The Project Advisory Committee cannot conclude that any error has taken place if a laboratory reported only methamphetamine.

Seven laboratories failed to report either ephedrine or methamphetamine. Among the methods used by these laboratories were Gas Chromatography, UV and IR Spectrophotometry, Color and Crystal Tests, GC/MS, X-Ray Diffractometry, and Thin-Layer Chromatography. In no instance would it appear that the failure to identify the drug materials could be attributed to a lack of available instrumentation or to insufficient methodology. The Project Advisory Committee can conclude that one of the following may have occurred:

- Inadequate data base or inadequate standard spectra,
- Misinterpretation of the test results by the operator resulting from carelessness or lack of experience.

Four laboratories reported the presence of amphetamine, the four being split on whether the amphetamine was the dextrorotary isomer or the racemic mixture. Each laboratory reported the use of gold chloride or platinic chloride for the identification of the material. The Project Advisory Committee can conclude that one of the following may have occurred:

- Mislabelled or contaminated primary standard,
- Reagent made up incorrectly,
- Misinterpretation of test results by the operator resulting from carelessness or lack of experience leading to failure to properly recognize and interpret crystal forms.

The Project Advisory Committee wishes also to point out that a quickly performed and easily interpreted color test exists to distinguish primary and secondary amines, and urges the application of this test when the circumstances warrant. The application of this test would have avoided the mistakes of the type under discussion.

Seventeen laboratories reported only ephedrine. The Project Advisory Committee considers the reporting of ephedrine only to be a less than correct response for this sample. The methods used by these laboratories run a full gamut of instrumental approaches, color and crystal tests, and chromatographic methods. The Project Advisory Committee urges the laboratories missing the methamphetamine to review their analytical approach to ensure that the presence of one non-controlled material will not mask the presence of another, controlled drug material. In the case of the phenethylamines, considerable caution should be placed on the interpretation of the results of Ultraviolet Spectrophotometry and color tests.

TEST SAMPLE #16 - PAINT

Test Sample #16 consisted of three items. Item A was an acrylic alkyd paint with titanium oxide as the pigment. Item B possessed the titanium oxide pigment also, but was a soya alkyd paint. Item C was also a soya alkyd paint, but contained, in addition to titanium dioxide, a substantial quantity of zinc oxide. All three items have traces of iron, zinc, lead and cobalt. This test sample Sample #16, is identical to the paint sample previously distributed as Test Sample #10A. A total number of 103 laboratories participated in this exercise.

Laboratories were asked if Item A could have shared a common origin with Item B, and if Item C could have shared a common origin with Item B. The correct responses to both questions would be no. Sixty-eight laboratories, or 66.0% of the total number participating, correctly reported no for Item A and no for Item C. Eleven laboratories, or 10.7% of the total, correctly reported no for Item C, but incorrectly reported yes for Item A. Eleven laboratories (10.7%) correctly reported no for Item A, but incorrectly reported yes for Item C. Three laboratories, or 2.9% of the total participating, incorrectly reported yes for both Item A and Item C. Three laboratories reported inconclusive results for Item A, but correctly reported no for Item C. Five laboratories (4.8%) reported inconclusive results for Item C, but correctly reported no for Item A. Two laboratories, representing 1.9% of the total number participating, reported inconclusive results for both Item A and Item C.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

Since Test Sample #16 was, in essence, a replicate of Test Sample #10A, some inprovement in the technical correctness of the test results was anticipated by the Project Advisory Committee and was observed. The overall performance of the participating laboratories was somewhat better for Test Sample #16 than for Test Sample #10A. A cross tabulation of the results reported from these two test samples is included in this section. The Project Advisory Committee wishes, however, to reaffirm the statements made in Supplemental Report #10A, and strongly urges that laboratories experiencing difficulty with Sample #16 review that Supplemental Report.

In particular, the Project Advisory Committee takes note of the great variation among laboratories in the use and interpretation of chemical spot tests and solubility tests. The Committee reaffirms its statement made in conncection with Test Sample #10A that LEAA/NILECJ should consider funding efforts in compiling and disseminating information and guidelines on the use and interpretation of spot tests and solubility tests, and for the standardization of solubility tests.

Those laboratories not employing elemental analysis should consider incorporating this type of approach in their protocol of analysis. Those laboratories who did employ elemental analysis, but failed to detect the large quantitative difference in Zinc composition between Items B and C should undertake an assessment of the validity and reliability of their instrumentation, methods of analysis, and guidelines for the interpretation of results.

Those laboratories failing to detect the organic differences in the vehicles in Items A and B should review their instrumentation, methodology, and operator skills in the organic analysis area. The Project Advisory Committee suggests that additional consideration be given to Pyrolysis-Gas Chromatography.

CROSS TABULATIONS OF RESPONSES

FOR SAMPLES #10A & 16

I.

Responded to Tests #10A and #16	83
Responded to #10A, No Response to #16	28
No Response to Tests #10A & #16	49
No Response to #10A, Responded to #16	10
No Sample #10A, Responded to #16	10
No Response to #10A, DND #16	2

Note: DND = Did Not Do

II. Of the 83 laboratories responding to Test Samples #10A and #16:

ACCEPTABLE* responses for both #10A and #16	33
ACCEPTABLE responses for #10A, UNACCEPTABLE** responses for #16	10
UNACCEPTABLE responses for #10A, ACCEPTABLE responses for #16	25
UNACCEPTABLE responses for both #10A and #16	15

III. Of the 28 laboratories responding to Test Sample #10A, but not to Test Sample #16:

ACCEPTABLE responses	10
UNACCEPTABLE responses	18

IV. Of the 10 laboratories who did not respond to Test Sample #10A, but responded to Test Sample #16:

ACCEPTABLE responses	5
UNACCEPTABLE responses	5

* The PAC defines an ACCEPTABLE response as Items A, B and C could not have common origin.

** The PAC defines an UNACCEPTABLE response as any response other than A, B and C could not have shared common origin or an inconclusive response.

TEST SAMPLE #17 - METAL

Test Sample #17 consisted of three items. Item A was a sample of National Bureau of Standards Reference Material 362, AISI 94B17 Steel. Items B and C were replicate samples of National Bureau of Standards Reference Material 19G, Acid Open Hearth Steel. A total of 68 laboratories participated in this exercise.

Laboratories were asked if Items A and B could have shared a common origin, if Items A and C could have shared a common origin, and if Items B and C could have shared a common origin. The correct response is a no to the first two questions, and a yes to the third. Sixty-two laboratories, or 91.2% of the total number responding, correctly reported that Items A and B could not have shared a common origin. Sixty-one laboratories, or 89.7%, correctly reported that Items A and C could not have shared a common origin. Fifty-one laboratories, or 75.0% of the total responding, correctly reported that Items B and C could have shared a common origin. Two laboratories, or 2.9%, incorrectly reported that Items A and B could have shared a common origin. Three laboratories, or 4.4%, incorrectly reported that Items A and C could have shared a common origin. Seven laboratories, or 10.3% of the total laboratories responding, incorrectly reported that Items B and C could not have shared a common origin.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

The correct response rate in the comparison mode suggests to the Project Advisory Committee that relatively few laboratories are experiencing difficulty in the analysis and characterization of metals. The Project Advisory Committee notes that the majority of the laboratories submitting incorrect responses relied heavily or exclusively on the emission spectrograph. The Project Advisory Committee concluded that these errors may have resulted from one or more of the following:

- Carelessness or lack of training or experience on the part of the operator;
- Failure to run appropriate standards to establish the sensitivity and resolution of this instrumental approach.

Two laboratories reporting that Items B and C could not have shared a common origin reported qualitative data derived from X-Ray fluorescence studies that would seem to support the correct response, i.e., that Items B and C could have shared a common origin, but that Item A is dissimilar. The Project Advisory Committee wishes to point out, as it has in previous Supplementary Reports, that an error in reporting may have the same consequences as an error in the analytical work, and suggests that laboratories review their procedures for ensuring that the conclusions stated in the reports are in consonance with the laboratory work which has been performed.

Very few laboratories responded with quantitative data, although they were encouraged to do so by the data report sheet, and despite the fact that many laboratories included quantitative data in connection with the paint samples #10A and #16 and the glass samples #4 and #9. The paucity of quantitative data prevents a detailed analysis of the data to be performed. The Project Advisory Committee, however, notes that the concentration of the metallic elements reported by different laboratories and determined by different instrumental techniques varies as much as 250 fold for the same metal sample, i.e., the same Item. The Project Advisory Committee wishes to reaffirm its comments made in connection with Supplemental Report #10, that those laboratories utilizing elemental analysis by whatever instrumental approach should take whatever precautions necessary to ensure that proper standards are run and that the operator possesses the requisite skill inventories to interpret the instrumental data. The lack of consistency in the reporting of the elements in the present exercise, both qualitatively and quantitatively, suggests to the Project Advisory Committee that elemental analysis is an area that deserves attention, and that laboratories should carefully review their methodology.

TEST SAMPLE #18 - HAIR

Test Sample #18 consisted of 5 items. Item A was Dog hair; Item B was Cat hair; Item C was Deer hair; Item D was Cow hair; Item E was Mink hair. The total number of laboratories responding in this exercise was ninety.

With respect to Item A, 43 laboratories, or 47.8% of the total responding, correctly identified the hair as having originated from a dog. Seventeen laboratories, or 18.9%, reported the hair as "non-human." Eight laboratories reported inconclusive results, and three laboratories provided no response for this item. Nineteen laboratories, or 21.1% of the total laboratories participating, identified the hair as being of some animal other than dog. Among these incorrect responses were Cow, Bear, Horse, Cat, Rat and Skunk.

With respect to Item B, 66 laboratories, or 73.3% of the total responding, correctly identified the hair as having originated from a cat. Thirteen laboratories, or 14.4%, reported the hair as "non-human." Two laboratories reported inconclusive results, and three laboratories provided no response for this item. Six laboratories, or 6.7% of the total participating, identified the hair as being of some animal other than cat. Among these incorrect responses were Dog, Mouse, Squirrel and Fox.

With respect to Item C, 41 laboratories, or 45.6% of the total responding, correctly identified the hair as having originated from a deer. Ten laboratories, or 11.1%, reported the hair as "non-human." Four laboratories reported inconclusive results, and four laboratories provided no response for this item. Thirty-one laboratories, or 34.4% of the total participating, identified the hair as being of some animal other than deer. Among these incorrect responses were Elk, Horse, Goat, Cow, Pig and Dog.

With respect to Item D, 31 laboratories, or 34.4% of the total responding, correctly identified the hair as having originated from a cow. Twelve laboratories, or 13.3%, reported the hair as "non-human." Seven laboratories reported inconclusive results, and 4 laboratories provided no response for this item. Thirty-six laboratories, or 40.0% of the total participating, identified the hair as being of some other animal than cow. Among these incorrect responses were Dog, Horse, Human, Opossum, Sheep (wool), Alpaca or Llama, and Rodent.

With respect to Item E, 57 laboratories, or 63.3% of the total responding, correctly identified the hair as having originated from a mink. Twelve laboratories, or 13.3%, reported the hair as "non-human." Four laboratories provided no response for this item. Seventeen laboratories, or 18.9% of the laboratories participating, identified the hair as some animal other than mink. Among these incorrect responses were Cat, Rat, Rabbit, Mouse and Squirrel.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

The Project Advisory Committee notes that the incorrect response rate ranged from 6.7% in the case of Cat hair to 40.0% in the case of Cow hair. The Project Advisory Committee urges that consideration be given to the greater likelihood of a misidentification with hairs of certain animals. The Project Advisory Committee wishes to draw particular attention to the situation involving Dog hair. Item A, the Dog hair, was misidentified by 21.1% of the laboratories responding. Item D, the Cow hair, was identified as Dog hair by 20 laboratories, or 22.2% of the total laboratories participating. The Project Advisory Committee views this error rate as being intolerably high, considering the fact that dog hair is so commonly encountered in hair evidence, and given the ease with which exemplar standards may be collected for a reference collection.

The Project Advisory Committee concludes that in the case of misidentifications of the animal hairs in this exercise, one or more of the following may have occurred:

- Misinterpretation of the microscopic appearance of the hairs resulting from carelessness or lack of experience on the part of the examiner;
- Inadequate reference collection of standard hairs, or mislabeled standards.

Since the identification of animal hairs rests almost exclusively on the microscopic appearance of the hairs, a greater premium is placed on the adequacy of the standard collection of hairs, and on the training and experience of the examiner. The Project Advisory Committee urges those laboratories experiencing difficulty in this exercise to review their methodology to ensure that these two areas are properly addressed.

The Project Advisory Committee urges LEAA/NILECJ to consider funding a project which will provide standard collections of hairs of various animals, much in the same manner as the automotive paint samples collected and distributed by the National Bureau of Standards.

TEST SAMPLE #19 - WOOD

Test Sample #19 consisted of three items: Item A was a specimen of Fir (Abies grandis); Item B was a specimen of Maple (Acer saccharum); Item C was a specimen of Pine (Pinus monticola). The total number of laboratories participating in this exercise was sixty-five.

Participating laboratories were asked if Items A, B, and C could have shared a common origin, and to provide a species origin for each sample if such a determination was part of the normal laboratory procedure for dealing with wood evidence. Fifty-one laboratories, or 78.5% of the total participating, correctly reported that Items A, B, and C could not have shared a common origin. Eight laboratories reported that Items A and C could not have had a common origin, but reported inconclusive results for Item B. One laboratory reported that Items A and B could not have had a common origin, but reported inconclusive results for Item C. One laboratory reported that Items A and B could not have shared a common origin and indicated no response for Item C. Four laboratories, or 6.2% of the total number participating in this exercise, incorrectly reported that Item C could have shared a common origin with Items A and B.

Twenty-eight laboratories did not attempt to determine the species for Item A. Sixteen laboratories, or 25.6% of the total number responding correctly identified the wood as Fir. Seven laboratories, or 10.8% of the total reporting, identified the wood as being a "softwood". Eight laboratories, or 12.3% of the total number participating, incorrectly identified the wood as Pine. Two laboratories incorrectly identified the wood as Cedar, two laboratories identified the wood as Spruce, one laboratory identified the wood as Redwood, one laboratory identified the wood as Hemlock, and one laboratory identified the wood as Chamaecyparis Cedar.

Twenty-eight laboratories did not attempt to determine the species for Item B. Twenty laboratories, or 30.8% of the total number responding, correctly identified the wood as Maple. Eight laboratories, or 12.3%, reported the wood as being a "hardwood". Two laboratories incorrectly reported the wood as Beech. One laboratory incorrectly reported the wood as Lithiocarpus (Tanbark Oak), one laboratory reported Birch, one laboratory reported Walnut, one laboratory reported Basswood, one laboratory reported Mahogany, and one laboratory reported Oak.

Thirty laboratories did not attempt to determine the species for Item C. Twenty-three laboratories, or 35.4% of the total number participating, correctly identified the wood as Pine. Seven laboratories, or 10.8% reported the wood as being a "softwood". Two laboratories incorrectly reported the wood as Cedar, one laboratory reported the wood as Fir, and one laboratory reported Redwood.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

The Project Advisory Committee considers the number of misidentifications of the wood samples to be intolerably high.

Since the identification of wood rests almost exclusively on a microscopic examination, a very great premium is placed on the training and experience of the examiner, and on the adequacy of standards and other reference sources. The Project Advisory Committee concludes that misidentifications of the wood samples may be attributed to one or more of the following:

- Carelessness or lack of experience on the part of the examiner
- Inadequate reference standards of known woods, or mislabeled standards

The Project Advisory Committee recognizes that many laboratories examine wood evidence only in a comparison mode, and do not attempt to identify the genus or species. The Project Advisory Committee further recognizes that while this approach will suffice in many instances, it does not develop the information that will fully exploit this type of evidence, and urges laboratories not now possessing the capability of identifying wood samples to initiate the actions necessary to acquire this capability.

TEST SAMPLE #20 - QUESTIONED DOCUMENTS

Test Sample #20 consisted of the following items: envelope bearing questioned typewriting; letter bearing questioned typewriting and handwriting, marked "Q"; exemplar handwriting consisting of four standard specimens from each of four individuals, and marked "B", "C", "D", and "E", respectively; typewriting standards prepared on Royal Upright, IBM Selectric, and IBM Selectric II, and marked "1", "2", and "3", respectively. A total number of seventy-four laboratories participated in this exercise. Several laboratories completed only portions of the exercise.

The typewriting on the questioned envelope was typed on typewriter "1", the Royal typewriter. The handwriting on the questioned letter was written by the individual designated "B". The typewriting on the questioned letter was typed on typewriter "3" (i.e., typed with the typing element or typing head on typewriter "3").

Sixty-six laboratories, or 89.2% of the total number participating identified individual "B" as having executed the handwriting on the questioned note. Four laboratories, or 5.4%, reported inconclusive results but specifically mentioned in their reports that they noted significant agreement between the questioned material and the exemplar handwriting of "B". One laboratory, representing 1.4% of the total number responding, identified suspect "B" for having executed one portion of the handwritten note, and incorrectly identified suspect "C" for the remainder of the note.

Sixty-six laboratories, or 89.2% of the total number participating correctly identified typewriter "1" as having typed the text on the questioned envelope. Seven laboratories, or 9.5% of the total, reported inconclusive results but made specific note of the agreement between the typewritten text on the envelope and the exemplar from typewriter "1".

Forty-eight laboratories, or 64.9% of the total number participating, correctly identified typewriter "3" as being responsible for the typewriting on the questioned note. (This includes the nine laboratories who made the distinction between identifying the typewriter and identifying the typing element.) Twelve laboratories, or 16.2%, reported inconclusive results for this phase of the examination but specifically noted the agreement between the questioned typewriting and the exemplar prepared from typewriter "3". Ten laboratories, or 13.5% of the total responding, incorrectly elminated typewriter "3" as having typed the questioned text.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

In connection with the handwriting portion of this exercise, one laboratory incorrectly reported that the exemplars labeled "B" and the exemplars labeled "E" were both written by the same person. One laboratory reported that one portion of the questioned note was written by suspect "B", and the remainder written by suspect "E". The Project Advisory Committee concludes that in these instances, the error resulted from inexperience or inadequate training on the part of the examiner. The Project Advisory Committee urges these laboratories to take appropriate actions to acquire the requisite training and experience to ensure technical competency.

Seven laboratories incorrectly eliminated typewriter "3" as having typed the text on the questioned note, but provided no information as to the bases of their conclusions. The Project Advisory Committee cannot, therefore, comment on the possible reasons for their erroneous conclusions. Three laboratories, however, eliminated typewriter "3" on the basis of pitch. The Project Advisory Committee wishes to draw attention to the possibility of encountering typewriters with variable pitch or proportional spacing, and cautions against the use of pitch as the sole criterion in eliminating certain typewriters as having possibly typed a questioned text.

One laboratory incorrectly reported that typewriter "3" could not have typed the questioned letter, and under the section of the data report form that asked for an explanation of any factors or observations which influenced the development of the opinion replied to the effect that "my opinions were reached based on my years of training and experience in the field of questioned documents". The Project Advisory Committee wishes to emphasize that the real issue is not the extent of an examiner's experience, but the quality of that experience, and that years of experience in the field of questioned documents does not in itself guarantee technical competency.

TEST SAMPLE #21 - FIREARMS EXAMINATION

Test Sample #21 consisted of three .25 caliber projectiles, each marked with a letter on the base. Those projectiles marked A, B, C, D, E, F, G, H, J, K, L, O, P, Q, R, S, T, U, V, Y were fired through a Wilkinson .25 Auto pistol, Serial Number 00386. Those projectiles marked I, M, N, X, Z were fired through a second Wilkinson .25 Auto pistol, Serial Number 00113. A total number of 88 laboratories participated in this exercise.

Five laboratories misidentified one projectile, incorrectly reporting that all three projectiles had been fired through a single weapon. This represents 5.7% of all laboratories responding. Three laboratories, or 3.4% of the total responding, incorrectly reported that none of the three projectiles could have been fired through the same weapon. A total number of nine laboratories, or 9.1% of the total responding, reported results that are clearly in error. Four laboratories, or 4.6% of the total, reported inconclusive results.

The Project Advisory Committee is in accord with the following general comments in regard to this sample:

> The Project Advisory Committee wishes to reiterate the comments made in the Supplemental Report pertaining to Test Sample #7, which also dealt with firearms evidence. Misidentifications such as those reported by five laboratories in the present exercise are particularly grave in nature, and the Project Advisory Committee urges the laboratories involved to immediately undertake such measures as necessary to correct their deficiencies. A criminal prosecution may hinge entirely, or virtually so, upon firearms evidence and the testimony of the firearms identification expert, and the potential exists for a truly severe miscarriage of justice. Responsibility for errors such as those under discussion rests squarely with the examiner and those responsible for his supervision. Similarly, the Project Advisory Committee wishes to point out the obvious fact that an erroneous elimination of firearms evidence may also lead to a miscarriage of justice. The Project Advisory Committee concludes that these errors may have resulted from one or more of the following:
>
> - Carelessness on the part of the examiner.
>
> - A lack of experience or training on the part of the examiner.
>
> - Inadequate or ineffectual supervision by a qualified firearms identification expert.

UNACCEPTABLE PROFICIENCIES

During the course of this Project, responses from the participating laboratories were tabulated and published in individual reports, a total of 21 in all. Supplemental Reports were also published at regular intervals which discussed errors, possible explanation of these errors, and means to correct them. The criteria for correct and incorrect responses summarized in the Supplemental Reports, however, were developed on an ad hoc basis, i.e., the criteria were developed in response to a particular sample. Although similar or identical criteria were employed for the same evidence type, e.g., the two paint samples, the criteria by necessity differed substantially between samples of different evidence types.

Upon the completion of the 21 samples, it became evident to the Project Advisory Committee that some means was necessary to bring the issue of the proficiency of all of the laboratories for all of the samples into some sort of common focus. This was accomplished by introducing the concept of "unacceptable proficiency," a doctrine which, briefly stated, suggests that there is room for improvement in the laboratory submitting responses falling into this category. Unacceptable proficiency is defined as a response falling into one or more of the following categories:

1). Totally incorrect response, e.g., the reporting of Librium when the controlled substance was pentobarbital.

2). In the comparison mode, a correct response for the wrong reasons, i.e., data that does not support the conclusion reported, even though the conclusion is coincidentally correct.

3). An unsupported inconclusive response, i.e., the laboratory reporting an inconclusive response but providing no information as to the nature of the uncertainty. In certain instances of this category, it is not apparent from the returned data sheets that any laboratory work was even attempted.

4). An unsupported inconclusive response where improper or inadequate methodology was employed, or where no subjective determination was involved.

5). Multiple responses, e.g., identification of a hair as either a sheep or a rodent or a dog.

6). An incomplete response, i.e., reporting results of a portion of the exercise but not the entire exercise.

Using these categories, the Project Advisory Committee developed criteria for unacceptable proficiency for all 21 samples (See Table 87).

The Project Advisory Committee is concerned that the concept of unacceptable proficiency not be misconstrued, and elaboration is perhaps necessary. The designation of unacceptable proficiency is not necessarily synonymous with error nor is it necessarily a measure of laboratory competency. It is instead a reflection of the fact that a laboratory must demonstrate proficiency in order to claim it. An imperfect response, for whatever reason (most certainly including legitimate reasons), does not constitute that showing of proficiency. This is probably most apparent in connection with inconclusive responses. From an ethical, professional, and technical perspective, an inconclusive response is in many instances the only possible conclusion. At the same time, there is nothing inherent in an inconclusive opinion that demonstrates proficiency. In applying the doctrine of unacceptable proficiency, the laboratory correctly identifying 4 hairs and reporting an inconclusive response for the fifth has not made an error. It simply has not demonstrated a proficiency with respect to this fifth hair.

Using the "unacceptable proficiency" criteria as indicated in Table 87, subsequent tables were developed illustrating the responses of all participating laboratories to each sample (see Tables 88, 89 and 90).

Table 90 summarizes the acceptable and unacceptable responses, the percentage of responses which were acceptable, and the number of laboratories falling into each percentile category, based on the number of tests performed. For example, of the 49 laboratories which fall into the 100% category, that 100% calculation is based on their responses to the number of tests they participated in; this can range from one test to nineteen tests (test numbers 18 and 21 are not included). Responses may total more than nineteen due to several tests requiring multiple answers. Table 91 further summarizes these data and illustrates, for example, that 25% of all laboratories which participated in the study had 100% acceptable responses; 34% of the laboratories had 90% or greater of their responses acceptable; and 66% or approximately two-thirds of the laboratories having 80% or more of their responses fall in the acceptable category.

TABLE 87

SUMMARY OF "UNACCEPTABLE PROFICIENCY" CRITERIA

Sample Number	Sample Type	Criteria for "Unacceptable Proficiency"
1	Drug	Responses of: Amobarbital, Butabarbital, Secobarbital, Phenobarbital, Sodium butabarbital, Sodium secobarbital, Librium, No drug found
2	Firearms	Failure to at least mention Smith & Wesson and Beretta among the possible candidate weapons
3	Blood	Any response other than blood type B; Unsupported inconclusive response
4	Glass	A response stating that the glass samples could have shared a common origin; inconclusive response
5	Paint	Any response other than C could have shared a common origin with A; inconclusive response
6	Drug	A response which failed to mention either heroin or cocaine
7	Firearms	Misidentification
8	Blood	Typing error in any system; unsupportable inconclusive
9	Glass	Any response other than A and B could have shared a common origin with C; inconclusive response
10A	Paint	Any response other than A, B, and C could not have shared a common origin; inconclusive response
11	Soil	Any response other than B and C could not have shared a common origin with A; inconclusive response
12	Fibers	Any response other than A and B could not have shared a common origin with C.
13	Physiological Fluid	Part A - Misidentification Part B - Unsupportable inconclusive
14	Arson	Any response other than A and C could have shared a common origin with B
15	Drug	Responses of: amphetamine, ephedrine only, or no drug found

TABLE 87

SUMMARY OF "UNACCEPTABLE PROFICIENCY" CRITERIA

Sample Number	Sample Type	Criteria for "Unacceptable Proficiency"
16	Paint	Any response other than A, B, and C could not have shared a common origin; inconclusive responses
17	Metal	Any response other than B and C could have shared a common origin; inconclusive response
18	Hair	Any response other than (a) dog; (b) cat; (c) deer; (d) cow; (e) mink; inconclusive response
19	Wood	Any response other than A, B, and C could not have shared a common origin; misidentification of species
20	Questioned Document	Part A - Any response other than B (except inconclusive) Part B - Envelope. Any response other than typewriter #1; unsupported inconclusive Part B - Letter. Any response other than typewriter #3; unsupported inconclusive
21	Firearms	Misidentification

TABLE 88

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

Lab Number	Test Sample Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20
1	A	NR	U	A	A	A	A	U	A	U	U	A	A/A	NR	A	NR	NR	U	NS
2	A	U	DND	A	U	A	A	NR	A	U	NR	A	DND	U	U	NR	NR	DND	NS
3	A	A	A	A	A	A	NS	U	U	NR	NR	NR	NR	NR	NR	NR	NR	NS	NS
4	A	A	A	A	A	A	A	NR	A	U	NR	NR	NR	U	A	NR	NR	NR	NS
5	A	A	A	A	A	A	A	U	A	U	A	A	A/A	A	U	A	DND	NR	NS
6	A	NR	A	A	A	A	A	U	A	U	A	A	NR	NR	U	U	DND	NR	NS
7	U	U	DND	A	A	A	U	NS	A	NR	U	A	A/U	U	U	NR	DND	DND	NR
8	A	U	A	NR	U	A	U	U	A	U	A	A	A/A	A	U	A	U	A	NS
9	A	DND	DND	DND	DND	A	NS	NS	NS	NS	DND	DND	A/A	DND	DND	NS	NS	NS	NS
10	A	U	DND	A	A	A	A	NS	NR	NR	NR	NR	NR	U	U	NR	NR	NR	DND
11	U	DND	A	DND	DND	NR	NS	U	NS	NS	NR	DND	NR	U	NR	NS	U	A	NS
12	NS	A	DND	NR	NS	NS	A	NS	NR	DND	DND	DND	DND	DND	DND	NS	DND	DND	A/U
13	NR	NR	NR	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
14	A	U	A	A	U	A	A	U	A	U	U	A	A/A	A	A	U	DND	A	A/A
15	A	A	A	A	A	A	A	U	A	A	A	A	A/A	A	A	NR	NR	A	NR
16	A	A	A	DND	DND	A	A	U	NS	NS	U	NR	A/A	NR	A	NS	U	U	A/A
17	U	NS	U	A	A	A	NS	NR	NR	NR	NR	NR	NR	A	NR	NR	NR	NR	NS
18	A	A	A	A	A	A	A	U	A	A	U	A	A/A	U	A	U	A	A	A/A
19	NR	NR	DND	DND	DND	NR	NR	NS	NS	NS	NR	NR	NR	DND	NR	NS	DND	DND	NR
20	A	A	A	A	U	A	U	A	A	U	A	A	A/A	A	A	U	A	A	A/A
21	A	A	A	A	A	A	A	U	A	U	A	A	A/A	A	A	A	A	DND	NR
22	A	A	A	A	A	A	A	U	U	U	A	A	A/A	A	A	A	A	A	A/A
23	A	DND	DND	DND	DND	NR	NS	NS	NS	NS	DND	NR	NR	A	NR	NS	DND	DND	NS
24	A	A	A	A	A	A	A	A	A	U	A	A	A/A	A	A	U	DND	NR	A/A
25	A	A	A	A	NR	A	A	U	NR	U	NR	NR	A/A	A	NR	NR	NR	NR	NR
26	A	A	A	A	A	A	A	A	A	A	NR	A	A/A	NR	U	U	DND	NR	NR
27	A	U	A	A	A	A	A	U	A	A	U	A	A/A	DND	A	A	A	U	NS
28	A	U	NR	NR	NR	NR	A	U	A	U	U	A	NR	NR	NR	NR	NR	NR	NS
29	A	A	A	A	A	A	A	U	A	A	A	A	NR	A	A	U	DND	NR	NS
30	A	U	A	NR	NR	A	A	NR	A	NR	NR	A	A/A	NR	U	NR	NR	A	A/A
31	A	NS	A	A	U	A	NS	A	NR	NR	NR	NR	NR	NR	NR	A	DND	DND	NS
32	A	U	A	A	NR	A	U	U	A	A	NR	A	A/A	NR	A	NR	NR	U	NS
33	A	A	A	NR	A	NR	A	A	NR	NR	NR	NR	NR	NR	NR	NR	DND	NR	NS
34	U	NR	U	A	NR	A	A	NR	U	U	A	DND	NR	A	A	A	A	NR	A/U
35	A	A	A	A	A	A	A	U	A	U	U	A	A/A	A	A	A	A	A	A/A
36	A	A	A	A	U	A	A	A	U	U	A	A	A/A	A	A	NR	A	A	A/A
37	A	U	A	A	A	A	A	U	U	NR	A	A	A/A	A	A	A	NR	A	NS

TABLE 88 (con't)

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

Lab Number	Test Sample Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20
38	U	DND	A	A	A	A	A	U	A	A	A	A	A/A	A	A	U	A	A	A/A
39	A	A	A	A	U	A	A	U	NR	U	A	NR	A/A	U	A	A	A	A	NS
40	A	NS	DND	DND	DND	A	NR	U	NS	NR	DND	DND	DND	A	U	NS	DND	DND	NS
41	A	DND	A	DND	DND	A	NS	NR	NS	NS	DND	A	NR	U	A	NS	U	DND	DND
42	A	U	A	A	NR	A	A	A	NR	NR	NR	A	NR	NR	NR	NR	DND	DND	NS
43	A	A	A	A	A	A	A	U	U	A	U	A	A/A	U	A	NR	NR	NR	A/A
44	A	NS	DND	DND	DND	NR	NS	NS	NS	NS	DND	NR	DND	DND	NR	NS	DND	NR	NS
45	A	NS	A	A	U	A	DND	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	DND
46	A	A	A	A	A	A	A	U	A	A	A	A	A/A	U	A	A	A	DND	NS
47	A	A	NR	A	A	A	NR	NR	A	NR	A	NR	A/A	NR	NR	NR	NR	A	U/A
48	A	DND	DND	NR	DND	A	NS	NS	DND	NS	DND	DND	DND	DND	A	NS	DND	DND	NS
49	A	NR	A	NR	NR	NR	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
50	A	A	A	A	A	A	A	A	A	U	U	A	U/A	A	U	NR	NR	NR	A/A
51	A	U	A	U	A	A	A	A	U	U	A	A	A/A	A	A	A	A	U	NS
52	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
53	A	U	A	A	A	A	A	A	U	U	NR	A	A/A	U	U	A	A	DND	A/A
54	A	A	A	A	A	A	A	U	U	A	NE	A	A/A	A	A	U	DND	DND	A/U
55	A	U	A	A	DND	A	A	A	A	NR	DND	DND	A/A	A	U	NS	DND	DND	NR
56	NR	A	DND	A	NR	NR	A	NS	NR	NR	DND	DND	NR	NR	DND	DND	DND	DND	A/A
57	A	NS	NR	NR	NR	A	NR	NR	NR	NR	NR	NR	NR	U	NR	NR	NR	NR	NS
58	A	A	A	NR	NR	A	NR	U	NR	A	NR	NR	NR	A	A	A	NR	NR	NR
59	DND	U	NS	A	A	DND	A	U	A	A	A	A	A/A	A	DND	A	A	A	A/A
60	NS	A	A	NR	NR	DND	A	NR	NR	NR	NR	A	NR	NR	DND	NR	DND	DND	A/A
61	A	NS	NR	NR	NR	NR	NS	NR	NR	NR	DND	DND	DND	DND	A	DND	NR	DND	NS
62	A	NS	DND	DND	DND	U	NS	NS	NS	NS	DND	DND	NR	NR	DND	NS	DND	DND	NR
63	A	DND	A	DND	U	A	DND	A	NS	U	DND	A	A/A	U	A	NR	DND	DND	A/A
64	A	NS	DND	DND	DND	A	NS	NS	NS	NS	DND	DND	DND	DND	A	NS	DND	DND	NS
65	A	NR	A	A	A	A	A	A	A	NR	DND	A	A/A	U	A	U	DND	DND	A/U
66	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
67	A	A	A	DND	NR	NR	A	U	NS	U	DND	A	A/A	A	U	A	DND	DND	DND
68	A	NS	A	DND	DND	A	NS	U	NS	NR	DND	NR	A/A	NR	A	NS	DND	DND	NR
69	A	NS	DND	DND	DND	A	NS	NS	NS	NS	DND	DND	DND	DND	NR	NS	DND	DND	NS
70	A	NS	DND	DND	DND	A	NS	NS	NS	NS	DND	NR	DND	DND	U	NS	DND	DND	NS
71	A	A	A	A	A	A	A	A	U	U	NR	A	A/A	A	U	NR	NS	NR	NR
72	A	NS	DND	NR	NR	NR	NS	NS	NR	NR	NR	NR	NR	DND	NR	NR	NR	NR	NR
73	NS	NS	NS	NS	NS	NS	NS	NS	A	A	U	A	A/A	A	A	A	A	A	A/A
74	A	A	A	A	A	A	A	U	U	U	A	A	A/A	A	A	A	A	A	A/A

TABLE 88 (cont'd)

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

Lab Number	Test Sample Number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20
75	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	U	A	A/A	U	A	U	DND	A	NS
76	A	A	A	A	A	A	A	A	A	A	U	A	U/A	A	A	A	A	A	U/U
77	A	NR	A	A	A	A	A	U	A	U	A	A	A/A	U	A	A	A	A	A/A
78	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
79	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	DND	DND	DND	NR
80	A	U	A	DND	DND	A	A	U	NS	NS	DND	A	A/A	U	A	NS	DND	DND	NR
81	A	U	A	A	A	A	A	A	A	A	A	A	A/A	A	A	A	A	DND	U/A
82	A	A	A	A	A	A	A	A	A	A	A	A	A/A	U	NR	A	A	NR	A/A
83	A	NS	A	DND	DND	A	NS	U	NS	NS	DND	A	A/A	A	NR	NS	DND	DND	NS
84	A	U	A	A	A	A	A	U	U	U	U	A	A/A	NR	A	A	DND	DND	A/A
85	A	U	A	A	A	A	A	U	A	A	A	A	A/A	U	NR	A	A	DND	NS
86	A	A	A	A	A	A	A	U	A	U	DND	A	A/A	A	A	A	A	DND	A/A
87	A	A	A	A	A	A	A	U	A	A	DND	NR	A/A	U	A	NR	A	A	A/A
88	A	NS	A	DND	DND	A	DND	NR	NS	NS	U	NR	NR	A	NR	NS	DND	DND	NS
89	A	NS	NS	NR	NR	NR	A	NR	NR	U	NR	NR	NR	A	NR	NR	NR	DND	NS
90	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	A	A	DND	NS
91	A	NS	DND	DND	DND	A	NS	NS	DND	DND	DND	DND	DND	DND	A	DND	DND	DND	NS
92	A	DND	DND	DND	DND	A	NS	NS	NS	NS	DND	DND	DND	DND	A	NS	DND	DND	DND
93	A	U	A	A	A	A	A	U	A	A	U	A	A/A	A	A	A	NR	DND	NR
94	NR	NR	NR	NR	NR	A	NR	U	DND	NR	NR	U	A/A	DND	A	A	DND	NR	NS
95	A	NR	NR	NR	DND	A	NR	NR	DND	NS	DND	DND	DND	DND	NR	NS	DND	NR	NR
96	A	NS	DND	DND	DND	DND	DND	NS	NS	NS	NR	NR	NR	NR	NR	NS	NR	NR	NR
97	A	NR	A	U	A	A	NR	NR	NR	NR	NR	NR	NR	A	NR	NR	DND	DND	DND
98	A	A	A	DND	DND	A	A	U	NS	NS	DND	DND	A/A	A	A	NS	DND	DND	NS
99	A	A	A	A	U	A	A	A	NR	NR	NR	A	A/A	NR	NR	NR	NR	NR	A/A
100	NR	NS	NR	NR	NR	DND	NS	NR	DND	DND	DND	DND	DND	DND	DND	NS	DND	DND	DND
101	A	U	A	U	A	A	A	U	A	U	A	A	A/A	U	A	A	A	A	A/A
102	A	A	A	U	A	A	A	A	NR	U	A	A	A/A	U	A	U	DND	NR	NS
103	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NS
104	A	NS	A	A	A	A	DND	U	A	A	U	A	A/U	U	A	A	A	U	NS
105	A	A	A	A	A	A	A	A	A	A	U	A	A/A	A	NR	A	DND	NR	U/U
106	A	U	A	A	A	A	A	U	A	U	U	A	A/A	NR	A	U	DND	U	NS
107	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NS
108	A	A	A	DND	DND	DND	DND	DND	NS	NS	DND	DND	DND	DND	DND	NS	DND	DND	NS
109	A	A	A	DND	A	A	A	U	A	A	A	A	A/A	A	U	A	NR	DND	A/A
110	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
111	A	A	A	A	A	A	A	U	A	A	A	A	A/A	A	A	A	NS	A	NS

TABLE 88 (cont'd)

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

Lab Number	Test Sample Number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20
112	A	NS	DND	NR	DND	A	NS	NS	DND	NS	DND	NR	NR	DND	NR	NS	NR	NR	NR
113	A	NS	DND	DND	DND	NR	NS	NS	NS	NS	DND	DND	DND	DND	NR	NS	NR	NR	A/A
114	NR	A	A	A	A	A	A	U	NR	U	NR	NR	NR	NR	NR	NR	NR	NR	NR
115	DND	U	A	DND	DND	DND	U	NR	NS	NS	NR	NR	A/A	NR	DND	NS	NR	NR	A/A
116	A	A	A	A	NR	A	A	DND	NR	A	NR	NR	DND	DND	A	NR	NR	NR	NR
117	A	A	A	A	A	A	A	U	A	A	A	A	A/A	DND	A	NR	DND	A	A/A
118	A	NS	NR	NR	NR	A	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
119	NR	A	NR	NR	NR	DND	A	DND	DND	DND	DND	DND	DND	NR	NR	NS	DND	A	DND
120	A	NR	DND	NR	NR	A	NR	NS	NR	NR	DND	NR	NR	NR	A	NR	NR	NR	NS
121	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	A	A	A/A	A	A	U	DND	NR	NS
122	A	NR	A	A	A	A	A	A	A	A	U	A	A/A	A	A	A	A	A	A/A
123	A	NS	NR	NR	NR	A	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
124	A	NS	DND	DND	DND	A	NS	NS	NS	NS	DND	DND	DND	U	A	NS	DND	DND	DND
125	A	A	A	A	A	A	A	U	U	A	U	A	A/A	A	A	A	DND	DND	NR
126	A	A	A	A	A	A	A	A	A	A	NR	A	A/A	DND	A	A	A	DND	A/U
127	A	A	U	A	NR	A	U	NR	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NS
128	A	A	A	A	A	A	A	U	A	A	A	A	A/A	U	A	A	A	A	NS
129	A	NS	A	A	A	A	DND	A	A	A	U	A	A/A	A	A	A	U	U	NS
130	A	NS	A	A	A	U	NS	U	U	U	A	A	A/A	U	A	A	U	NR	NR
131	A	A	A	A	A	A	A	A	A	A	U	A	A/A	A	A	A	U	A	NS
132	A	A	NR	A	A	A	A	A	A	NS	A	A	A/A	A	NR	A	A	DND	NS
133	A	A	A	A	A	A	A	A	A	U	A	A	A/A	A	A	U	DND	DND	A/A
134	A	NS	DND	U	NR	A	NS	NS	NR	NR	NR	NR	A/A	NR	NR	NR	NR	NR	NR
135	A	NR	A	A	A	NR	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	A	NR	NR
136	A	NS	A	DND	A	A	DND	U	NS	A	DND	A	A/A	A	NR	U	DND	A	NS
137	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	A	DND	DND	DND	NS
138	A	A	A	A	A	A	A	NR	A	A	A	A	A/A	A	A	A	A	A	A/A
139	A	NS	A	DND	DND	A	NS	U	NS	NS	DND	DND	A/A	A	U	U	DND	NR	NS
140	A	NR	A	NS	A	A	A	A	U	A	NR	A	NR	U	A	A	A	DND	NR
141	NS	NS	NS	DND	DND	A	NS	NS	DND	NS	DND	DND	NR	DND	A	NS	DND	DND	NS
142	A	A	A	A	A	A	A	U	A	NR	NR	NR	NR	A	A	A	NR	NR	A/A
143	A	NR	NR	A	NR	NR	NR	DND	DND	DND	NR	NR	NR	NR	NR	NR	NR	NR	NR
144	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	A/A
145	A	A	A	A	A	A	A	U	A	A	A	A	U/A	A	A	A	A	DND	A/U
146	A	NR	A	A	NR	A	A	U	NR	NR	NR	NR	A/A	NR	A	NR	NR	NR	A/A
147	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NR	DND	DND	A	DND
148	A	NS	DND	DND	DND	A	DND	NS	NS	DND	DND	DND	DND	DND	A	NS	DND	NR	NS

TABLE 88 (cont'd)

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

Lab Number	Test Sample Number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20
149	A	NS	DND	DND	DND	A	DND	NS	NS	DND	DND	DND	DND	DND	A	NS	DND	DND	DND
150	A	A	A	A	A	A	A	A	A	U	A	U	A/A	U	A	A	A	A	A/A
151	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
152	U	A	U	U	U	A	A	U	U	NR	NR	A	A/A	A	A	U	DND	DND	NR
153	A	NS	A	A	A	A	DND	U	A	A	DND	A	A/A	A	A	A	DND	DND	DND
154	U	A	A	A	NR	A	A	U	NS	U	NR	NR	NR	NR	U	NR	NR	A	A/A
155	U	U	DND	DND	U	NR	A	DND	DND	NR	DND	DND	DND	NR	A	U	DND	U	A/A
156	A	A	A	A	NR	NR	A	U	A	U	NR	NR	NR	NR	NR	NR	NR	NR	A/A
157	NR	U	A	NR	NR	NR	NR	NR	NR	A	NR	NR	A/A	NR	DND	NR	NR	NR	NS
158	A	NR	NR	NR	NR	U	NR	DND	DND	DND	DND	DND	DND	NR	U	NS	DND	NR	NR
159	A	A	U	A	A	A	A	U	A	A	A	A	A/A	A	U	U	U	A	NS
160	A	NR	A	A	U	A	A	U	U	A	A	A	A/A	A	A	A	U	DND	A/A
161	A	DND	A	DND	DND	NR	DND	U	NS	DND	A	A	A/A	A	NR	NS	DND	DND	NS
162	NS	NS	NS	NS	NS	NS	NS	NS	U	U	DND	A	A/A	A	A	U	U	A	A/U
163	NR	NS	DND	DND	DND	A	NS	DND	DND	DND	NR	NR	NR	NR	NR	NS	NR	NR	NS
164	A	NS	A	DND	DND	A	NS	U	NS	NS	A	A	A/A	NR	A	NS	DND	DND	NS
165	A	NS	A	DND	DND	A	NS	U	NS	NS	DND	DND	A/A	NR	U	NS	DND	DND	NS
166	A	A	A	NR	A	A	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	A/U
167	A	A	A	A	U	A	A	A	A	U	U	A	A/A	U	A	U	A	DND	A/A
168	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
169	U	NR	A	NR	NR	A	A	NR	NR	NR	NR	NR	NR	NR	NR	U	DND	NR	NS
170	A	A	A	A	A	A	A	U	A	U	NR	A	A/A	A	A	U	NR	DND	NS
171	A	A	A	A	A	A	A	U	A	A	A	A	A/A	A	A	A	DND	A	A/A
172	U	U	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
173	A	NS	A	DND	NR	NS	NS	U	NS	DND	A	A	A/A	DND	NR	NS	DND	DND	DND
174	A	NS	NR	NR	NR	NR	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
175	A	NS	A	NR	NR	A	NS	U	NR	NR	NR	NR	NR	A	NR	NR	NR	NR	NS
176	A	A	DND	A	A	A	A	NS	U	U	U	A	NS	A	A	NR	DND	DND	NS
177	U	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
178	A	A	A	NR	NR	NR	NR	NR	NR	NR	NR	A	NR	DND	NR	U	NR	NR	NR
179	A	A	A	A	U	A	A	U	A	U	A	A	A/A	A	A	A	DND	DND	NS
180	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
181	A	A	NR	NR	NR	NR	A	NR	DND	NR	DND	NR	NR	DND	NR	NR	NR	NR	A/A
182	A	NS	A	A	NR	A	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR	DND	NR	NS
183	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NR	A	NR	A	A	NR	NR	NR	NS
184	U	NS	A	A	A	A	A	U	NR	U	NR	A	A/A	U	A	NR	NR	DND	NS
185	A	DND	DND	DND	DND	A	NS	NS	NS	NS	DND	DND	DND	DND	DND	NS	DND	DND	NS

TABLE 88 (cont'd)

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

Lab Number	Test Sample Number																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20
186	A	DND	A	A	A	A	NS	U	A	U	A	A	A/A	A	A	U	A	A	NR
187	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	A	NR	NR	A	NR	A	A	NR	DND
188	A	A	A	A	U	A	A	A	U	A	DND	A	DND	NR	A	A	NR	DND	A/U
189	A	NR	NR	NR	A	A	A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NS
190	A	NR	A	NR	U	A	A	U	NR	U	DND	DND	A/A	DND	A	U	DND	DND	A/U
191	A	NS	DND	DND	DND	A	NS	NS	NS	NS	DND	DND	DND	NR	DND	NS	NR	DND	A/U
192	NS	A	A	A	A	A	NR	A	A	A	A	A	A/A	A	A	A	NR	A	A/A
193	A	A	A	A	A	A	A	NR	A	NR	NR	NR	NR	NR	NR	NR	A	NR	DND
194	A	U	NR	A	A	A	A	U	NR	NR	DND	DND	NR	NR	NR	NR	NR	NR	DND
195	A	A	A	NR	NR	A	A	NR	NR	NR	DND	NR	NR	NR	NR	NR	DND	NR	NS
196	A	NS	DND	DND	DND	A	DND	NS	NS	NS	DND	A	A/A	DND	A	NS	DND	DND	NS
197	A	U	A	A	A	A	A	A	U	U	U	A	A/A	A	A	U	U	A	A/A
198	A	A	A	A	U	NR	A	NR	DND	A	NR	NR	NR	NR	NR	NR	NR	NR	NR
199	A	A	A	A	A	A	A	A	U	U	A	A	A/A	A	NR	A	A	A	DND
200	A	NS	A	DND	NR	A	NS	NR	NS	NR	DND	DND	NR	NR	NR	NR	DND	DND	NS
201	A	NS	A	A	DND	A	NS	U	U	NS	NR	NR	NR	NR	A	A	U	A	NR
202	A	U	A	A	NR	A	A	U	NR	NR	NR	NR	A/A	A	NR	NR	NR	NR	NR
203	A	NS	DND	NR	DND	NR	NS	DND	DND	NS	DND	DND	DND	DND	NR	NS	NR	DND	DND
204	A	NS	A	DND	DND	A	NS	U	NS	NS	DND	DND	DND	DND	NR	NS	A	DND	NS
205	NR	DND	DND	DND	DND	DND	NS	NS	NS	NS	DND	DND	DND	DND	NR	NS	DND	DND	NS
206	A	NS	A	DND	DND	A	NS	U	NS	NS	DND	DND	DND	DND	DND	NS	NR	DND	DND
207	A	U	DND	DND	DND	A	A	NS	NS	NS	NR	NR	DND	NR	A	NR	NR	NR	NS
208	A	NS	A	DND	DND	A	NS	U	NS	NS	DND	DND	A/A	A	A	NS	DND	NR	NS
209	A	A	A	A	A	A	A	U	A	U	A	A	A/A	A	NR	A	A	DND	A/A
210	NS	NS	NS	NS	NS	NS	NS	NS	U	U	NR	A	A/A	A	A	NR	NR	NR	A/A
211	U	U	NR	NR	NR	A	U	A	DND	U	NR	NR	NR	A	A	U	NR	NR	A/A
212	A	NS	A	A	U	A	NS	U	U	A	A	A	A/A	NR	U	A	U	A	DND
213	A	NS	A	A	U	A	NS	U	U	U	U	A	A/A	NR	U	A	NE	A	NS
214	U	NS	A	A	A	A	NS	U	U	A	U	A	A/A	NR	NR	U	NR	NR	A/A
215	A	NS	A	A	A	A	NS	U	A	U	A	A	A/A	DND	U	A	A	U	NS
216	A	U	A	A	A	A	A	U	A	A	A	A	A/A	U	NR	A	NR	A	NS
217	A	A	A	A	A	A	A	U	A	A	A	A	A/A	A	A	A	A	U	NS
218	A	A	A	A	A	A	A	A	U	U	U	A	A/A	A	A	U	U	U	A/A
219	A	NS	A	AQ	A	A	NS	U	A	A	U	A	A/A	A	A	A	A	U	NS
220	U	U	A	A	U	A	A	A	A	U	A	A	A/A	A	U	NR	NR	NR	NR
221	A	A	A	A	A	A	A	U	A	U	U	A	A/A	DND	A	A	A	A	NS
222	A	NS	A	DND	DND	A	NS	U	NS	NS	DND	NR	NR	NR	A	NS	A	U	NS

TABLE 88 (cont'd)

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

Lab Number	Test Sample Number																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20
223	A	NS	DND	DND	DND	A	NS	NS	NS	NS	A	DND	DND	DND	A	NS	DND	DND	NS
224	A	A	DND	A	A	A	A	NS	U	U	DND	DND	DND	DND	A	A	DND	A	A/A
225	A	NR	A	NR	NR	A	NR	NR	NR	NR	NR	NR	NR	NR	A	NR	DND	DND	NS
226	A	A	A	A	DND	A	A	U	A	NS	DND	NR	A/A	NR	A	NS	NR	NR	NS
227	A	NS	A	DND	DND	A	NR	U	NS	NS	NR	A	A/A	DND	A	NS	DND	DND	NS
228	NR	NR	DND	NR	NR	NR	NR	NS	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
229	A	A	A	A	A	A	A	U	U	A	U	A	A/A	A	A	U	A	A	NS
230	A	A	A	NR	A	A	A	U	NR	NR	NR	NR	A/A	NR	A	A	NR	A	NR
231	A	A	A	A	U	A	A	NR	U	U	DND	A	NR	DND	A	NR	NR	NR	A/A
232	A	A	A	A	U	A	A	NR	A	A	A	A	A/A	A	A	NR	A	DND	A/U
233	A	U	A	A	A	A	A	U	A	A	A	A	A/A	A	A	A	A	DND	A/A
234	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NR	A	NR	NR
235	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	A	A	A/A	A	A	A	A	A	A/A
236	NS	A	A	A	A	NR	A	A	U	NS	NR	A	A/A	A	A	A	A	A	A/A
237	NS	A	A	A	A	NS	A	U	A	NR	NS	A	A/A	A	NR	NR	NR	NR	A/A
238	A	U	A	A	NR	A	A	NR	U	NR	U	NR	NR	NR	NR	U	DND	DND	NS
239	A	A	A	DND	DND	A	A	A	NR	A	A	A	A/A	NR	A	NR	NR	NS	NS
240	A	A	A	A	A	A	A	U	A	A	A	A	A/A	U	U	U	U	A	A/A
241	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
242	NR	NR	NR	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
243	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	A	NS	DND	NS	NS	NS	NS	NS	NS
244	NS	NS	NR	NR	NR	NR	NS	NR	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS	NS
245	NS	NS	NR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
246	A	A	DND	A	A	A	A	NR	U	A	DND	DND	A/A	U	A	U	DND	DND	NS
247	A	A	A	A	A	A	A	NR	DND	DND	DND	A	NR	U	NR	NS	NR	DND	NS
248	A	NS	DND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
249	A	NS	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
251	NR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
252	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
253	A	NS	NS	NR	NR	A	NS	NR	NR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
254	U	NS	A	A	U	A	NS	A	U	NR	NR	NR	A/A	DND	NS	NS	NS	NS	NS

TABLE 88 (cont'd)

AGGREGATE RESULTS OF PARTICIPATING LABORATORY RESPONSES TO TEST SAMPLES # 1-21*

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*Each point in the matrix represents the response given by a laboratory for a particular test which is coded as follows:

NS - Sample Not Sent

NR - No Response Received

DND - Does not perform test

A - Acceptable Proficiency Demonstrated

U - Unacceptable Proficiency

The "Lab Number" in the far left-hand column bears no relationship to the code number assigned to laboratories in the course of the research study.

Test Sample #18 is not included in this table because it contained five (5) different responses.

Test Sample #13 has been broken down into two (2) responses per the instructions on the Data Sheet.

TABLE 89

PERCENTAGES OF LABORATORIES REPORTING RESULTS OF "UNACCEPTABLE PROFICIENCY"

$$\frac{\text{Number "unacceptable" responses}}{\text{Number of laboratories responding with data}} \times 100 = \text{Percent "Unacceptable"}$$

Sample Number	Sample Type	Number of Labs Responding With Data	Number of "Unacceptable" Responses	% of Laboratories Submitting "Unacceptable" Responses
1	Drugs	205	16	7.8%
2	Firearms	124	35	28.2%
3	Blood	158	6	3.8%
4	Glass	129	6	4.8%
5	Paint	121	24	20.5%
6	Drugs	181	3	1.7%
7	Firearms	132	7	5.3%
8	Blood	132	94	71.2%
9	Glass	112	35	31.3%
10	Paint	111	57	51.4%
11	Soil	93	33	35.5%
12	Fibers	120	2	1.7%
13	Physiological Fluids (A&B)	129	(A) 3	(A) 2.3%
			(B) 2	(B) 1.6%
14	Arson	118	34	28.8%
15	Drugs	143	26	18.2%
16	Paint	103	35	34.0%
17	Metal	68	15	22.1%
18	Hair (A,B,C,D,&E)	90	45	(A)50.0%
			25	(B)27.8%
			49	(C)54.4%
			61	(D)67.8%
			32	(E)35.6%
19	Wood	65	14	21.5%
20	Q.D. (A&B)	74	4	(A) 5.4%
			14	(B)18.9%
21	Firearms	88	12	13.6%

TABLE 90

DISTRIBUTION OF PROFICIENCY RATINGS AMONG PARTICIPATING LABORATORIES*

Percentage	A	U	Number of Labs
100.0	20	0	1
	18	0	1
	15	0	1
	12	0	1
	11	0	1
	9	0	1
	8	0	1
	6	0	4
	5	0	3
	4	0	6
	3	0	13
	2	0	13
	1	0	3
95.0	19	1	2
94.7	18	1	1
94.4	17	1	3
94.1	16	1	2
92.9	13	1	2
92.3	12	1	3
91.7	11	1	2
90.9	10	1	2
90.0	18	2	2
	9	1	1
89.9	17	2	7
88.9	16	2	6
	8	1	3
88.2	15	2	1
87.5	7	1	5
86.7	13	2	2
85.7	18	3	5
	6	1	6
85.0	17	3	4
84.6	11	2	3
83.3	15	3	2
	10	2	2
	5	1	1
82.4	14	3	10
81.8	9	2	2
81.3	13	3	2
81.0	17	4	2
80.0	12	3	2
	8	2	2

* Does not include Tests 18 and 21.

TABLE 90

DISTRIBUTION OF PROFICIENCY RATINGS AMONG PARTICIPATING LABORATORIES

Percentage	A	U	Number of Labs	Percentage	A	U	Number of Labs
	4	1	7	69.2	9	4	2
78.9	15	4	2	68.8	11	5	2
77.8	14	4	4	66.7	10	5	2
	7	2	1		8	4	1
76.9	10	3	3		6	3	1
76.5	13	4	1		4	2	1
76.2	16	5	2		2	1	3
75.0	15	5	1	64.7	11	6	1
	12	4	2	64.3	9	5	1
	9	3	2	62.5	10	6	1
	6	2	3		5	3	2
	3	1	5	61.5	8	5	1
73.7	14	5	3	61.1	11	7	1
72.7	8	3	1	60.0	9	6	1
72.2	13	5	1		3	2	2
71.4	15	6	2	58.3	7	5	1
	10	4	2	55.6	5	4	1
	5	2	7	54.5	6	5	2
70.6	12	5	1	53.3	8	7	1
70.0	14	6	1	50.0	4	4	1
	7	3	1		1	1	1

TABLE 90

DISTRIBUTION OF PROFICIENCY RATINGS AMONG PARTICIPATING LABORATORIES

Percentage	A	U	Number of Labs	Percentage	A	U	Number of Labs
46.2	6	7	1				
44.4	4	5	1				
33.3	2	4	1				
	1	2	2				
0.0	0	1	1				

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TABLE 91

PERCENTAGE OF RESPONDING LABORATORIES HAVING "X"% OR GREATER OF THEIR RESPONSES WITHIN THE "ACCEPTABLE" RESPONSE CATEGORY*

Percentage of Total Responses Considered Acceptable*	Number of Laboratories In This Percentage Range	Percentage of All Participating Laboratories Having This Rating	Cumulative Frequency In Percent
100%	59	25.3	25.3
95.0-99.9%	2	0.9	26.2
90.0-94.9%	18	7.7	33.9
80.0-89.9%	74	31.8	65.7
70.0-79.9%	45	19.3	85.0
60.0-69.9%	22	9.4	94.4
50.0-59.9%	7	3.0	97.4
Below 50%	6	2.6	100.0
TOTALS	233	100.0	N.A.

* Does not include Tests 18 and 21.

GENERAL FINDINGS

1. Voluntary, anonymous proficiency testing is both feasible and necessary as indicated by the consistently high participation rates throughout the course of the project and the ability of such testing to identify areas in need of improvement.

2. The data collected from the participating criminalistics laboratories are not amenable to classical statistical formatting and presentation. However, other meaningful statistical formattings for the tabulation and presentation of what are considered to be unique data collection were possible.

3. There is a need for continuous proficiency testing programs at either the national, state or local levels to provide a means to monitor the progress of efforts to upgrade and maintain high quality criminalistics services.

4. There are still areas in which the proficiency testing program can expand:

   a) Many evidence types have yet to be tested (e.g., toolmarks, explosives, imprint evidence, fracture, tear and splatter patterns);

   b) Many of the evidence types that were selected for sample manufacturing were not fully exploited and were often presented in their simplest or most unchallenging forms (e.g.,the hair sample did not include human hair, the firearms sample included only bullets and cartridge cases);

   c) The samples can become more realistic by incorporating contaminants and by minimizing sample size and quantity.

5. Laboratory anonymity and the confidentiality of the submitted data are key factors to insure a high participation rate in a voluntary program such as this one.

6. A wide range of proficiency levels among the participating laboratories exists, and in general, there are several evidence types with which the laboratories are having serious difficulties.

7. The need for a practical time table which does not tax the workload of the participating laboratories, the sample manufacturers and the program administrators has been implicitly demonstrated.

8. Many of the nation's crime laboratories lack one or more of the fundamental criminalistics services as evidenced by the variability of participation and reporting rates with respect to the various evidence samples.

9. There was no uniform procedure by which the crime laboratories processed the evidence samples. Personal contact with some of the laboratories confirmed that the handling of the samples were subject to the following variables:

a) The examiner ranged from being the most competent and experienced in the laboratory to the novice or trainees;

b) The methods for analyzing the samples ranged from the routine to a complete overkill;

c) The number of examiners analyzing the sample ranged from one to an entire group;

d) The sample may have been processed either in-house or may have been sent out of the laboratory for analysis.

10. The data derived from this research project cannot be utilized to make evaluative or comparative judgements between individual crime laboratories with respect to their abilities to perform in the various evidence categories. The results must be viewed within the parameter of the test design and only then in regard to general performance of all laboratories.

11. The responses to the questions on the data sheets suggest that a lack of uniformity exists in examination and reporting procedures. For instance, a saliva sample might be reported as "non-seminal," an animal hair as "non-human," or a blood sample is characterized solely by its ABO grouping.

12. Unacceptable laboratory proficiencies most often could be attributed to one or more of the following problems:

a) Misinterpretation of the test results by the examiner resulting from carelessness or lack of experience;

b) Failure to employ adequate methodology, or failure to employ appropriate methodology;

c) Mislabelled or contaminated primary standards;

d) Inadequate data bases or standard spectra.

13. Laboratory responses to a survey show that most laboratories cannot afford to participate in a proficiency testing program on a subscription (fee) basis.

CHAPTER V

RECOMMENDATIONS

1. A nationwide program of continuous proficiency testing of crime laboratories should be established and administered by a peer group such as the one developed in this research program.

2. Future proficiency testing programs should contain provisions to render technical assistance to the laboratories which desire and request such help.

3. A series of LEAA funded remedial training workshops which are designed to address the shortcomings in laboratory performance identified in the findings of this project should be immediately developed.

4. Future proficiency testing programs of this type (i.e., one with voluntary, anonymous participants) should develop a fail-safe means for anonymous mailings as well as record keeping.

5. The Law Enforcement Assistance Administration is urged to recognize and undertake the continued, financial responsibility for maintaining what has been a successful proficiency testing program.

6. It is recommended that LEAA respond to the following specific laboratory needs:

    a) The compilation and publication of firearms class characteristics under a single cover;

    b) The funding of research projects to develop more reliable antisera for the MN blood grouping system, as well as other antisera specifically used for forensic purposes;

    c) The funding of research efforts to compile and disseminate information/guidelines on the use and interpretation of solubility tests in the examination of paint.

    d) The funding of a project which will provide standard collections of hairs of various animals, much in the same manner as the automotive paint samples collected and distributed by the National Bureau of Standards.

7. There should be continuous LEAA support of certification and accreditation programs within the field of criminalistics as evidenced by the problems identified in this report. Such programs should be carefully conceived and administered by professionals within the field.

8. Law enforcement agencies at all levels of government should recognize that the existing crime laboratory problems that were noted during the course of this research project may be linked to deficiencies in the budgets, physical and human resources of laboratories which have been cited in previous studies and other reports and should allocate the sufficient resources to finally correct these deficiencies.

CHAPTER VI

EPILOGUE

This final report has attempted to navigate the reader through a three-year long project, one that was both ambitious in scope and productive in the final analysis. Many of the findings however, are neither new nor unexpected to anyone who has kept abreast of the literature emanating from the assessments, evaluations, surveys and task force reports pertaining to the qualitative aspects of forensic science, specifically, the crime laboratory. In reality, the final report of the proficiency testing project has documented in greater and more concrete detail many of the observations and findings of these earlier works.

During the course of the proficiency testing program, it was quickly recognized that many of the laboratories were experiencing difficulty in the examination and analysis of various physical evidence types. To be perfectly candid, this could be expected. All of the previous reports which have addressed the issue have inferred the likelihood of such a finding. An examination of the criminal justice literature published during the last fifteen years reveals an increasing awareness of the crime laboratory's role in the adjudication of criminal justice. Many believe that this new awareness was sparked in part by the advent of the _Miranda_ and _Escobedo_ decisions.

> We have learned the lesson of history, ancient and modern, that a system of criminal law enforcement which comes to depend on the "confession" will, in the long run, be less reliable and more subject to abuse than a system which depends on extrinsic evidence independently secured through skillful investigation.[1]

This sentiment was reiterated by the President's Crime Commission in 1967 which stated:

> More and more, the solution of major crime will hinge upon the discovery at crime scenes and subsequent scientific laboratory analysis of latent fingerprints, hair, fibers, blood and similar traces.[2]

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[1] _Escobedo_ v. _Illinois_, 378 U.S. 478, 488 (1964).

[2] President's Commission on Law Enforcement and Administration of Justice, _Task Force Report: The Police_ (Washington, D.C.: U.S. Government Printing Office, 1967), p. 51.

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Thus, the need for the crime laboratory was firmly established during the 1960's which consequently initiated several research studies on various aspects of the crime laboratory. The results of these studies were, in many ways, discouraging. As early as 1963, a study conducted by Brian Parker revealed that less than one percent of the total criminal violations at the local level received laboratory examination; nonetheless, crime laboratories were so short handed that they were estimated to handle caseloads five times the size they should have been.[3]

Alfred Blumstein, in an article published in 1967, remarked that "...most police crime labs contain little more than a fingerprint kit, a camera, maybe a darkroom, and sometimes a comparison microscope."[4] The Law Enforcement Assistance Administration's predecessor, the Office of Law Enforcement Assistance, published a study in 1968 which disclosed that "...nearly every laboratory in the United States and Canada is overcrowded, understaffed, underpaid, underequipped and overworked."[5] An LEAA funded project by the Midwest Research Institue published in 1970 noted the pressing need for "...short courses, seminars and formal academic programs at the graduate level..." in the criminalistics field.[6]

The poor conditions which prevailed in the crime laboratories did attract the attention of the federal government. The creation of the LEAA in 1968 provided the means for some federal aid to reach the laboratories. Unfortunately, the late 1960's also witnessed an overwhelming influx of street drugs which, by law, mandated scientific analyses if the alleged offender was to be held and prosecuted. Thus, the laboratories were forced to direct the majority of their resources to the development of their drug analysis capabilities which stunted the growth of their overall laboratory capabilities. Currently, laboratories still devote a very substantial proportion of their limited resources to the examination and identification of controlled substances.

It is acknowledged that crime laboratories have improved noticeably during the past ten years. However, this has not been sufficient to meet the increasing responsibilities that they must fulfill. One of the most fundamental problems is inadequate budgetary support from the laboratories' parent agencies. The National Advisory Commission on Criminal Justice Standards and Goals Report of Police (1973) stated: "Too many police crime laboratories have been set up on budgets that preclude the recruitment of qualified, professional personnel." And further: "Too often the laboratory is not considered a primary budget item and is one of the first units to suffer when budgets are trimmed. Such practices relegate the crime laboratory to an inferior position among other support services." [7] The National Advisory Commission also included a recommendation which now appears to be a forerunner of the proficiency testing concept: "It is recommended that a national program be established to insure that all tests and analyses performed by State, regional or local laboratory facilities are procedurally sound and scientifically valid." [8]

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[3] Brian Parker, "The Status of Forensic Sciencein the Administration of Criminal Justice," Rev. Jur. U.P.R., XXXII, No. 2 (1963), 414, 417.

[4] Alfred Blumstein, "Police Technology," Science and Technology, No. 72 (December, 1967), p. 42.

[5] Alexander Joseph, Crime Laboratories--Three Study Reports, LEAA Project Report (Washington, D.C.: U.S. Department of Justice, 1968), p. 84.

[6] Walter R. Benson, John E. Stacy, Jr. and Michael L. Worley, Systems Analysis of Criminalistics Operations, LEAA Grant NI-044 (Kansas City, Mo.: Midwest Research Institute, 1970), p. 9.

In short, the final report of the proficiency testing project has described the symptoms of old problems, problems which have been brought to our attention on numerous occasions in the past. Consequently, the crime laboratories are not demonstrating optimal proficiency because it is circumstantially impossible for them to do so. The casual relationships between managerial and budgetary problems and the degree of laboratory proficiency are, needless to say, complex; still, we can cite some more obvious ones. Can we not, for example, deduce that a laboratory in financial straits is incapable of attracting and supporting superior scientific personnel? And would not the absence of such personnel negatively affect the proficiency of laboratory performance? Can we not deduce that a laboratory in need of additional manpower would be forced to "move cases through" as quickly as possible to combat an increasing backlog, foregoing additional confirmatory analyses or double checks by a second criminalist? And would this not also negatively affect laboratory proficiency as a whole? There are a host of other considerations, among them, unsatisfied needs for on-going education and training, unsatisfied needs for advanced or superior instrumentation, unsatisfied needs for adequate laboratory facilities and unsatisfied needs for better administrative decision and policy making, which all adversely affect laboratory proficiency in varying degrees. This report documents that crime laboratories have been and are still in need of help.

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[7] National Advisory Commission on Criminal Justice Standards and Goals, Police, Standard 12-2 (Washington, D.C.: U.S. Government Printing Office, 1973), pp. 304-305.

[8] Ibid, p. 316.

The proficiency testing program has been controversial in that many laboratory directors wondered whether the findings indicated by the research would constructively or destructively affect the laboratories. Again, it should be stated that the research findings, for the most part, could be predicted. To deliberately document the shortcomings of the crime laboratory operations with hard data and then walk away from it would be completely destructive and senseless. However, based on previous experiences where needed aid has been refused, many of the directors feared this. In the best interest of both the crime laboratory as well as equitable criminal justice, the proficiency testing program was supported, in the end, by the laboratory directors with the optimistic hope that the results would compel a change for the better. Indeed, the findings of the proficiency testing data should be the last straw in bringing whatever aid is necessary to the crime laboratories. The laboratories acknowledge that they are helpless without the support of the federal, state and municipal governments, and it is to them that the crime laboratories must turn for aid in taking remedial measures and securing adequate resources for improved laboratory operations.

Aside from greater resource allocations to the laboratories at the local level, the most pressing needs of the crime laboratories fall into the areas of certification of personnel, accreditation of crime laboratories, accreditation of forensic science degree programs, regional remedial workshops to upgrade the training of current laboratory personnel, research for improved techniques in the analysis of the various physical evidence types. The criminalistics community has already addressed many of these needs and developed several others into concept papers or grant proposals for federal support.

As a final note, the proficiency testing program has shown that laboratories can be extremely proficient. Many of the laboratories around the country displayed excellence in the examination and analysis of virtually all the categories of physical evidence submitted by the project staff. This is, without a doubt, a great tribute to those laboratories, as well as to their supporting agencies and local governments.

APPENDIX A

ROSTER OF PARTICIPATING LABS*

*Note: This roster is not intended to serve as a comprehensive list of criminalistics facilities, but as a list of locations which were at some time included in this project. The appearance of any particular laboratory on this roster does not necessarily indicate participation in testing.

During the course of this project, several of the facilities which appear on this roster withdrew, others consolidated and yet others were closed.

Director
Alaska Crime Lab
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M. Dale Bloomer, Criminalist
P.O. Box 866
Selma, AL 36701

James C. Britton, III
Toxicologist
P.O. Box 2411
Tuscaloosa, AL 35401

James M. Buttram, Ph.D., Director
Alabama Dept. Toxicology and
Criminal Investigation
P.O. Box 2646
Birmingham, AL 35202

John Case
Criminalist
P.O. Box 529
Jacksonville, AL 36265

John H. Kilbourn, Toxicologist
P.O. Box 2234
Florence, AL 35630

Lamar Miller, Criminalist
P.O. Box 119
Enterprise, AL 36330

Vann V. Pruitt, Jr.
Toxicologist
P.O. Box 128
Huntsville, AL 36804

Dr. C.J. Rehling, Director
Alabama Dept. Toxicology and
Criminal Investigation
Box 231
Auburn, AL 36830

Richard A. Roper, Toxicologist
P.O. Box 565
Montgomery, AL 36101

James L. Small
Courthouse
Church & Royal Streets
Mobile, AL 36602

Capt. James L. Neighbours
Criminal Investigative Service
Arkansas State Police
P.O. Box 4005
Little Rock, Arkansas 72203

W.J. Collier, Director
Crime Detection Lab.
620 W. Washington
Phoenix, AZ 85003

Carl R. Kempe, Director
City County Crime Lab
P.O. Box 1071
270 South State Avenue
Tucson, AZ 85702

David Kutob, Ph.D.
Crime Lab
2010 West Encanto Blvd.
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Lt. Wayne Bailey
San Diego Co. Sheriff's Ofc.
Crime Lab
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Allen J. Boudreau
Fresno County Sheriff's Ofc.
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James W. Brackett, Jr., Dir.
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Orange Police Dept.
Crime Lab
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W. Jack Cadman
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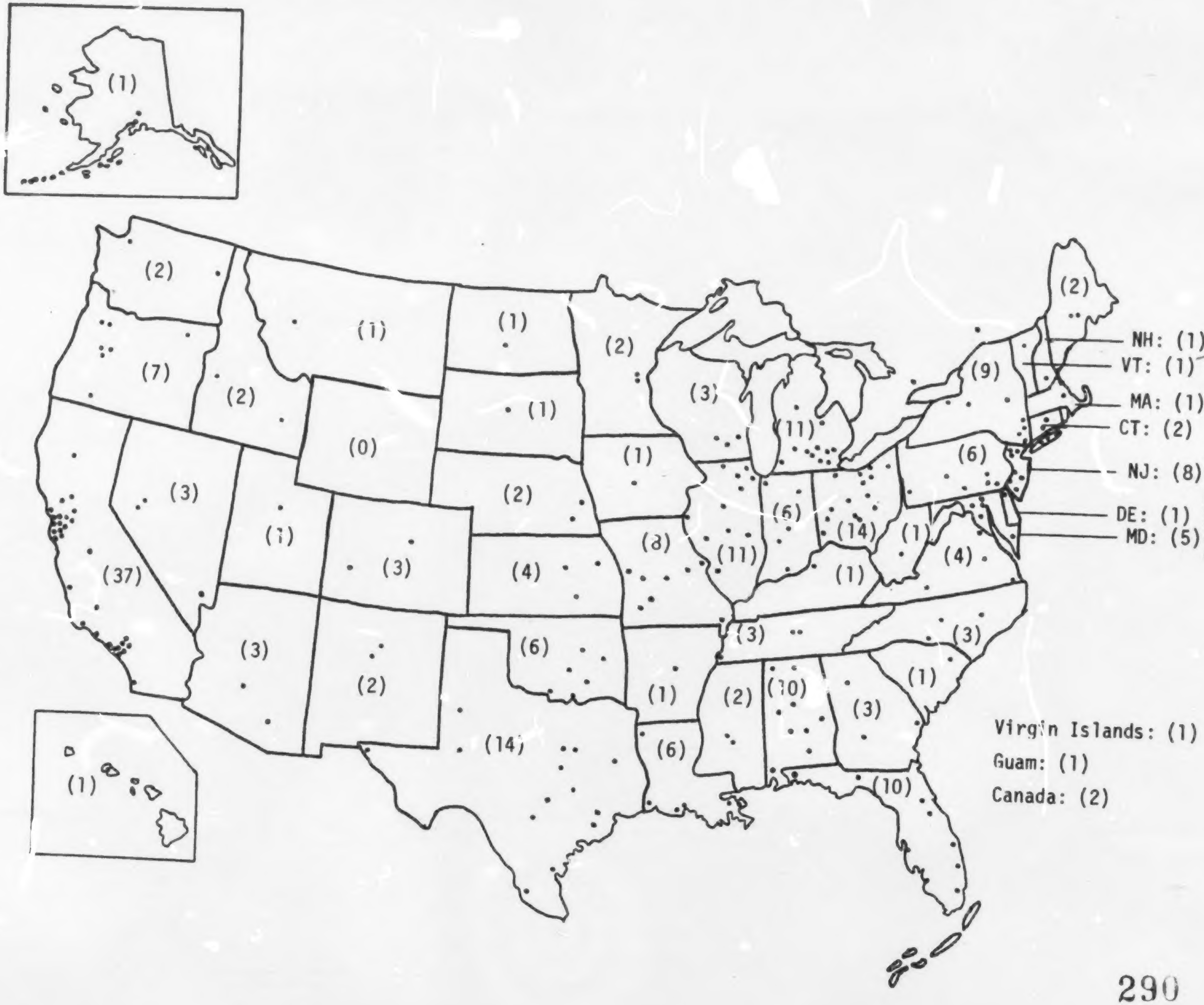
APPENDIX B

LABORATORY LOCATIONS

APPENDIX B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Virgin Islands: (1)
Guam: (1)
Canada: (2)

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